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JANUARY 5TH — JUNE 29TH, 1850.

EDITED BY J. C. ROBERTSON.

VOL. LII.

"Who loves not knowledge? Who shall rail
Against her beauty? May she mix
With Men and prosper!"—TENNYSON.

"THE MAN OF PROGRESS is one who perpetually imitates, who ceaselessly takes up new modes of thought and being into his own, and that not only in the case of the more perfect manifestations of intelligence, but of the lowest and most ordinary works of nature and art."—ANON.

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AGENTS:—FOR MANCHESTER, F. WISE, 3, COOPER-STREET
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HAMBURGH, W. CAMPBELL.

1850.

# ALPHABETICAL LIST OF NEW PATENTS GRANTED FOR ENGLAND, SCOTLAND, AND IRELAND.

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| Beatson | Computing angles | 29 Jan. | .... | .... | 99 |
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| Name. | Subject. | England. | Scotland. | Ireland. | Page. |
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## TO THE FIFTY-SECOND VOLUME

## LIEUTENANT GORDON'S MARINE STEAM ENGINES.

(Registered December 28, 1849.)

The accompanying engravings represent a design for a pair of marine steam engines which Lieut. Gordon has lately submitted to the Lords of the Admiralty, and has, for the sake of better verification, registered under the Designs Act. They may be considered as exhibiting the matured fruits of that long and diligent study of the subject, of which Mr. Gordon has already given proofs in his published Treatise, and also of the extensive practical experience which he has had as an officer of the Steam Navy, having been first officer of the *Inflexible* during her late steam service round the world—a service "far exceeding anything yet accomplished by any other vessel of the Royal Navy." We shall first give Mr. Gordon's own description of this arrangement, as it appears on the files of the Designs Office, and then append to it some letters addressed by him to the Admiralty, which contain a full exposition of its merits and advantages.

### *Description.*

Fig. 1 is a side elevation, partly in section, of a pair of engines. AA are the cylinders, which are placed close together, and set in a fore and aft line with the two cranks, B B, upon the main-shaft C. D D are the induction ports, and EE the eduction ports: the latter are of the usual size, but the former are much smaller, being just of sufficient size to permit the elasticity of steam in the cylinder to equal that in the boiler when cut off at one-tenth of the stroke. *a* is the expansion valve, *b*, the regular steam valve; *cc* other slides moved by hand, when necessary, by which the area of the ports may be lessened, and the steam so cut off at less than one-tenth of the stroke. The expansion valve is worked by means of the wheel gearing *dd*, and has an uniform continuous motion communicated to it. The slide, or steam, and eduction valves are worked by an eccentric, in the usual manner. Motion is communicated to the paddle-wheel shafts by pinions, F F, which work within wheels, G G, keyed on the ends of each paddle-wheel shaft. These wheels are toothed inside the periphery, as clearly shown in fig. 2, which is a part cross-section of the connections of the mainshaft with the paddle-wheel shaft. I is the boiler, which is of the locomotive form, with a fire-grate surface equal to that now employed for engines of an equal nominal power, and worked at a pressure of not less than 45 lbs. on the square inch. The steam previous to being supplied to the cylinders is passed through an annular steam chest, *k*, placed within the base of the funnel and above the top of the boilers. The waste feed-water for the boilers is supplied by the evaporation of salt water, contained in flat chambers, L L (surrounding the funnel), the steam evaporating from which is condensed in vessels placed in the paddle-boxes; and this water, previous to being forced into the boilers, is heated in the spiral pipe M, placed in the smoke-box. The boilers are to be protected by coal-boxes extending over them to the level of the surface of the water. The configuration of the parts described, together with the pressure of steam employed, admits of the engines, when the pistons are travelling at double the ordinary velocity, being able to propel the paddle-wheels with an equal effect to engines of double the nominal power on the present system of construction, and with also about half the usual consumption of fuel.

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### *Official Correspondence.*

### No. I.

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*To the Secretary of the Admiralty.*

London, October 2nd, 1849.

Sir,

1. I beg permission to draw the attention of the Lords Commissioners of the Admiralty to the great and unnecessary expenditure of fuel in Her Majesty's steamers, and to submit a plan for their Lordship's consideration, by means of which the *cost of*, and *space occupied* by, marine engines will be reduced *one half;* whilst their expenditure of fuel at *full speed*, and *all other* velocities, will likewise be diminished *one half*—as also will be their *weight* and liability to damage from

shot. On the other hand, their capability of performing distances under steam, with a given amount of fuel, will be *doubled*.

2. I further beg leave to submit, that the system which has been recently pursued with a view of producing a greater economy of fuel, has, unfortunately, in some instances, had quite a contrary effect. The system to which I allude is the erroneous one of carrying out the principle of expansion by means of engines and boilers which bear a greater proportion to tonnage than either science or experience warrants.

Fig. 1. Fig. . 2

3. Hence it has been assumed that the nominal horses-power should in all cases bear a proportion equal to *half* the tonnage. But if a certain ratio (such as *half*) be assumed as correct for a given tonnage, it is equally clear that the proper proportion of *all* other vessels should be in the ratio of the *squares* of the *cube roots* of their tonnage,

$$\left[\left(\sqrt[3]{\text{Tonnage}}\right)^2\right]$$

that is, if it were deemed correct to place engines of 500 horses-power in a vessel of 1000 tons (such as the *Sphynx*), it would be erroneous to place 800 horses-power in a vessel of 1600 tons (such as the *Retribution*); and yet this practice has been carried out. The proper amount, in the latter case, should have been 684 horses-power instead of 800 horses-power; for,

$$\text{As } \sqrt[3]{1000}^{\,2}\text{, or } 10^2 = 100 : \overset{\text{H.P.}}{500} :: \sqrt[3]{1600}^{\,2}\text{, or } 11{\cdot}7^2 : \overset{\text{H.P.}}{684}.$$

4. Having devoted my attention to the particular study of this subject for several years, I beg leave to submit, for their Lordships' consideration, that I will undertake to place such engines and boilers into *any steam-vessel* afloat—that her consumption of fuel at FULL SPEED shall only amount to *one half* of what it has hitherto been under the present system.

5. I do not propose any fundamental deviations from established rules in the construction of engines and boilers, but such a peculiar adaptation of well-tried means as will insure the success of the object in view, viz., a reduction of one-half the expenditure of fuel in all cases, and under all circumstances, together with a corresponding reduction in the *cost* and *weight* of engines and boilers.

6. A portion of the improvements which I now have the honour to propose were some time since brought under the notice of a former Board of Admiralty, through the medium of a "Treatise on the Economy of Marine Steam Engines," which I published in 1845. Since which period my own experience, and that of others, has fully confirmed the justness of my anticipations—that the general introduction of low-pressure engines of a high nominal power would not meet the ends of economy.

7. As a proof of the correctness of the assertions which I have made in the second paragraph of this letter, I beg to draw the attention of their Lordships to the comparative performance of Her Majesty's steam vessels *Inflexible* and *Fury*, whilst employed on the China station between the months of December, 1848, and June, 1849.

8. These vessels are precisely alike in form and tonnage, with the same armaments and complements of men, whilst the *Fury* has the advantage of spreading a larger amount of canvas. The engines of the *Inflexible* are, however, only of 378 horses-power, whilst those of the *Fury* are 515 horses-power—an amount being nearly equal to half her tonnage; but, notwithstanding this disparity, the following statements will prove that the performance of the *Inflexible* in the stated period has been superior to that of the *Fury*; although the *Fury's* proportion of power arrives so nearly at the standard of perfection which has been aimed at in adopting the present system of expansion.

9. Comparative statement of performance of Her Majesty's ships, *Inflexible* and *Fury*:—

*Between December*, 1848, *and June* 1849.

H.M.S. *Inflexible* steamed.... 8590 miles by patent log,
and consumed ............ 1250 tons of fuel,
in performing that distance at
the rate of............. 6·8 miles per ton.

*Between November*, 1848, *and June*, 1849.

H.M.S. *Fury* steamed and sailed .... 7500 miles,
and consumed.................. 1450 tons of fuel,
in performing that distance at the
rate of ...................... 5·2 miles per ton.

The above distances were performed in nearly the same localities, and in similar weather; the *Fury* having towed, during the period, Her Majesty's ship *Hastings* a distance of about 1600 miles; but she also made use of sails, only for a great part of one voyage, which reduces the cases to much similarity.

The *speed* of the *Inflexible* is also superior to that of the *Fury*, although her power is so much *inferior*. This was proved by the voyage which these vessels made from Hong Kong to Singapore in May last, each having the same quantity of coals on board at starting, and both experiencing calms and smooth water throughout the passage. The *Inflexible* performed the distance in a few hours less time, and with a *smaller* expenditure of fuel than the *Fury*; thus proving the failure of that system which endeavours to economise fuel by the employment of engines and boilers which are quite disproportioned to the wants of the vessel.

10. Another instance of great expenditure from the same causes occurs in the case of Her Majesty's steam-ship *Medea*, whose former engines of 220 horses-power have been replaced by a pair of 350 horses-power; and on a recent trial in calm and smooth water, working expansively with one boiler, her consumption of fuel was about 35 tons in a distance of 320 miles, or at the rate of about 9 miles per ton; whilst the *Inflexible*, although of 300 tons greater measurement, would, under similar circumstances, have obtained at least 11 miles per ton.

11. I further beg to demonstrate, by a comparative statement of the miles per ton obtained in the cases of the *Cyclops* and *Inflexible*, how small has been the superiority of the latter vessel, although the *Cyclops* did not use *expansion* gear:—

| | |
|---|---|
| H.M.S. *Cyclops* consumed, in three years.... | 5,467 tons, |
| in steaming ........................... | 29,314 miles, |
| at the rate of ........................... | 5·5 miles per ton, |
| or allowing for greater tonnage .......... | 6· do. do. |
| H.M.S. *Inflexible* consumed, in three years .. | 8,500 tons, |
| in steaming............................ | 64,714 miles, |
| at the rate of ........................... | 7·61 miles per ton. |

But, in the latter case, about 24,000 miles were performed in making long voyages on low powers, and with the constant aid of fair winds and sails. Under sails alone she has performed about 4000 miles in addition.

12. Whilst employed on the New Zealand station, between January and June, 1847, the *Inflexible* was under steam about 29 days, performing a distance of 5083 miles with an expenditure of 875 tons of fuel, at the rate of about 5·8 *miles* per ton, and in this instance showing no superiority over the average performance of the *Cyclops*.

Secondly.—Between December 1848, and June, 1849, the *Inflexible* performed, under steam and sail, a distance of 11,503 miles with an expenditure of 1686 tons of very good fuel, at the rate of 6·8 miles per ton, showing a slight superiority over the average performance of the *Cyclops*.

Thirdly.—Her Majesty's ship *Vixen* steamed for eleven days, on her passage to the Cape, against the S.E. trade wind, at an average rate of at least 7·5 knots per hour, and an expenditure of only 23·5 tons per day of inferior fuel, or 7·6 miles per ton.

13. These facts will prove how slight has been the *economical* superiority of even the *Inflexible* over the *Cyclops* and *Vixen*, whilst the inferiority of the *Fury* and other vessels having similar engines of great proportionate power, has been likewise pointed out.

14. Lastly: I would beg to call their Lordships' attention to the large expenditure which has been incurred by fitting engines of 500 horses-power to the *Fury* and many others of her class, when, even under the old system, it has been proved that engines of 380 horses-power would have been more effective, whilst saving a sum of at least 5000*l.* each in prime cost, and effecting a considerable reduction in *weight* and expenditure of fuel.

But, by the plan which I propose, a further saving of *one-half* in all points would be undoubtedly effected upon the most economical vessel which has hitherto been tried.

It appears by the Navy List that there are about sixteen new steam sloops and frigates either in the course of construction or ordered to be built. Permit me respectfully to request, that no further contracts should be entered into for their engines until a fair trial has been given to the system which I have now the honour to propose for their Lordships' consideration.

In conclusion, I beg to state that the plans which I propose are equally applicable to the screw-propeller, which has hitherto been less successful than it ought to be, owing to the errors which have been committed in its construction, and which I have already pointed out in a paper which was laid before Sir George Cockburn, when senior Sea Lord of the Admiralty.

In have the honour to be, Sir,
Your obedient humble servant,
W. E. A. Gordon,
*Late Senior Lieut. of H.M.S. Inflexible.*

P.S.—As a further illustration of the points which I have endeavoured to prove in the body of this letter, I beg to subjoin a comparison of the recent voyage made by H. M. ship *Inflexible* from Bombay to Portsmouth, with a similar one which was performed by the Hon. E. I. Company's steamer *Berenice* from Falmouth to Bombay in the year 1837.

In 1849.

| | | |
|---|---|---|
| H. M. S. *Inflexible* steamed and sailed | 11,166 | miles, |
| per patent log, in ............ | 61 | days, 19 hours, |
| with a consumption of ........ | 1,200 | tons of coals, |
| (average) at the rate of ........ | 7·6 | knots per hour, |
| ,, a consumption of .... | 20·4 | per day, |
| and performing 8·9 miles per ton of coals. | | |

In 1837.

| | | |
|---|---|---|
| H. E. I. C. ship *Berenice* steamed and sailed .................. | 11,800 | miles, |
| per patent log, in ............ | 63 | days, 8 hours, |
| with a consumption of ........ | 1,076 | tons of coals, |
| (average) at the rate of ........ | 7·7 | knots per hour, |
| ,, a consumption of.... | 17·0 | tons per day, |
| and performing 10·9 miles per ton of coals. | | |

It will be seen from the above that the *Berenice* has made the most successful voyage of the two, although she had the disadvantage of performing the *outward-bound voyage*, and was a new vessel. She also took a longer route by 640 miles, which was caused by her calling at Fernando Po.

Her tonnage was less than the *Inflexible's*, which would be counterbalanced by the well-known superiority of a large vessel over a small one in ocean navigation.

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## No. II.

*To the Secretary of the Admiralty.*

London, November 19th, 1849.

Sir,

1. I beg to acknowledge the receipt of your letter of the 13th instant, acquainting me that my Lords Commissioners of the Admiralty had signified their intention of causing my plan for *saving fuel, space, cost, &c.*, in Her Majesty's steam vessels, "to be investigated" on my transmission of a distinct description of it.

2. In compliance with their Lordships' desire, I beg to acquaint you that the construction which I propose does not involve any principle which has not already had the full test of experience in proving its successful application.

3. In order to build a pair of engines which should be of equal power to a pair of the present construction, having cylinders of 75½ inches diameter and 6 feet length

of stroke, or a collective (nominal) power of 440 horses, I would order from the manufacturer a pair of engines having cylinders of 56 inches diameter with a five-foot stroke, or a collective (nominal) power of 228 horses.

4. The principle would be direct action, with a parallel motion similar to that of the *Gorgon* engines, and the engine itself would stand in a space of about 15 feet by 6. The condensers would be on the cold surface principle, and stand apart from the engines, thus giving easier access to every part, and a more favourable distribution of space.

5. The steam pipes would be of small diameter, and about 6 feet below the surface of the water. The steam and expansion valves would be of an improved description; and it is to their superior action that a portion of the successful performance of the engine will be due.

6. The boilers should be four in number, having a grate surface of about 100 square feet, and of the locomotive description, with various new arrangements for their perfect adaptation to a marine engine. The space occupied by them would be about 20 feet in length by 18 in breadth, and only 6 in height, thus bringing their crowns from 3 to 4 feet beneath the surface of the water. My improvements would consist in a new apparatus for feeding the furnace and consumption of smoke, thoroughly drying the steam, clearing the priming, and raising the temperature of the *feed*. A provision of a new description would also be introduced for supplying the wastage of feed-water. The draught in the furnaces would have little more than the usual velocity in marine boilers, and, as less than half the grate surface would be employed, there would be a corresponding reduction in the expenditure of fuel.

7. It is well known that the rapid deterioration, and, consequently, expensive repairs, of locomotive boilers, is chiefly caused by the violence of the draught through the tubes, and intensity of heat which is thereby caused in the furnaces; and there is likewise more or less incrustation, according to the nature of the water which is evaporated. These causes of decay would be completely obviated in my plan by the sole use of distilled water, combined with a moderate draught and intensity of combustion in the furnaces.

8. The maximum steam pressure should be from 45 to 50 lbs. per square inch, whilst the boilers should be constructed of the same strength as those in common use on railways, whose load upon the valve amounts to 70 or 80 lbs. per square inch.

9. AT FULL SPEED the steam would be cut off at ONE-TENTH of the stroke; thus realizing (what has most unaccountably been hitherto neglected) the same (or a greater) amount of economy than has been obtained in Cornish engines, where the principle of expansion has *not* been applied to the best advantage.

10. In the two engines which I have placed in comparison, the speed of the pistons in the low pressure principle would be, at 18 revolutions, =216 feet per minute. At the same power, my engine would make 36 revolutions, and the speed of the pistons would be 360 feet per minute, with a mean effective pressure in the cylinders of about 20 lbs. per square inch, or (superior to that in the old engine) with an evaporation of half the quantity of water, and consequent expenditure of only half the fuel.

11. I beg to assure their Lordships that the conclusions I have arrived at are based upon the closest study of the subject in all its bearings, with a careful observation and comparison of every engine in general use; but I can scarcely hope for success in proving my points unless their Lordships will be pleased to sanction the construction of an engine on my plan (should it be approved of as practicable) by any manufacturing engineer whom their Lordships may be pleased to point out. When I advert to the fact that H. M. S. *Inflexible* expended the enormous quantity of *eight thousand seven hundred tons* of fuel in three years, I am most anxious that a fair trial should be given to a plan which, in this instance alone, might have effected a saving of 4,000 tons of fuel, or 8,000*l*., together with the unnecessary labour to the crew, which always has a bad effect upon their health and general efficiency. For the above-mentioned sum *so expended*, an engine might be built

which would, in *any case*, be equal to its *nominal power*, and perfectly adapted for transferring to a smaller vessel, should it be necessary.

Trusting that my solicitations may obtain a favourable hearing,

I have the honour to be, Sir,

Your most obedient humble Servant,

W. E. A. GORDON,

*Lieutenant, R. N.*

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## No. III.

*To the Secretary of the Admiralty,*

London, Dec. 3rd., 1849.

Sir,

I have the honour to acknowledge the receipt of your letter of the 24th ultimo, acquainting me that there "was nothing novel in the views set forth" in my letter of the 17th ultimo.

With regard to the want of "novelty" in my plans for saving fuel in steam vessels, I have distinctly stated in both my letters, as a just ground for their being entertained, that the principles upon which I proposed to effect so great a saving in fuel and engines "had long been known and acknowledged, but had hitherto been most unaccountably neglected;" and that I did not propose any "fundamental deviations from established rules in the construction of my engines and boilers, but such a peculiar adaptation of well-tried means as would ensure the success of my object."

But I claim as "novel" the act of at once adopting the well-known principles of economy in all future engines, by means of arrangements and alterations which are quite novel in their general combination, and have never as yet been attempted in any steam-vessel afloat. No marine engine can be perfect in its economy unless it is constructed to expand high-pressure steam through at least 9-10ths of the stroke when working at full power. This would be quite impracticable with the present form of low-pressure engines; but, having invented an engine which can fulfil the necessary conditions, I had hoped that their Lordships would have been pleased to sanction its construction, subject to the approval of its practicability by a manufacturing engineer.

I have the honour to be,

&c., &c., &c.,

W. E. A. GORDON,

*Lieut. R. N.*

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### STEAM-BOAT FORMS.

A ship at rest is retained so by equal and opposite pressures, but which are altered in degree when she is set in motion: the resistance which the water offers to her motion ahead may be called plus pressure, and that which sustains her in the position attained, the minus pressure.

When a vessel is moved at a low velocity, the power required to propel her will not be great—only sufficient to overcome inertia and sustain that which is imparted; for the plus and minus pressures under such circumstances will be equal, as the water is not moved out of her path with velocity, while it has time to flow in behind before she has passed ahead.

At low velocities, their form is a matter of small economic importance.

But, *cæteris paribus*, the plus pressure increases with the velocity, and the minus pressure decreases; then, as the power required to overcome the total resistance varies as the cube, or is greater when high velocities are desired, it becomes a matter of the first importance to attend to the form.

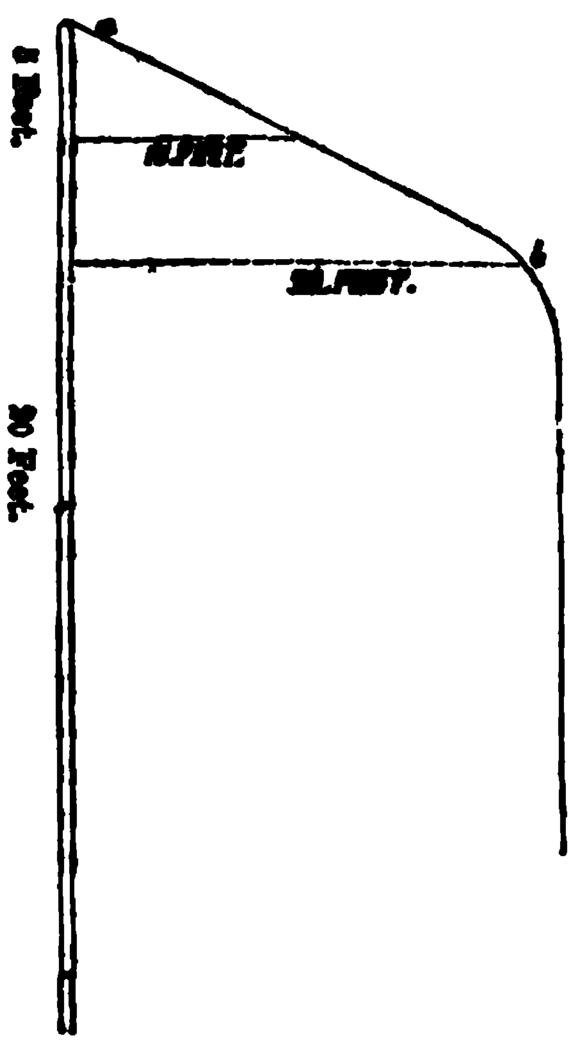
First, let us examine the influence which the length of bow has upon the plus pressure at different velocities.

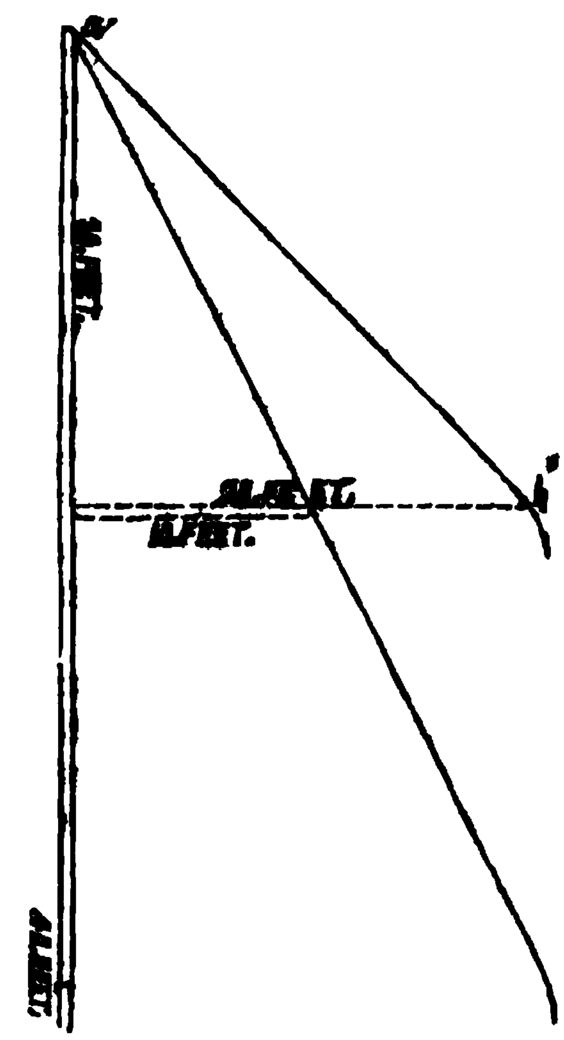
For which, suppose a vessel of 20 feet half breadth, both sides being alike, the argument will be the same for each, and the bow to be 10 feet long, as in fig. 1.

If the vessel have a velocity of 5 feet

per second, the water, in its passage from *a* to *b* out of her path, will require to move only at the rate of 10 feet per second, and the resistance would be comparatively small; but if the velocity of the vessel be increased to 20 feet per second, then the water in its passage from *a* to *b* must move at a velocity of 40 feet per second: that is, it must move over 20 feet while the vessel moves forward 10 feet; and the resistance in the first case will be as the square of 10 to the square of 40 in the second: that is, the velocity is increased four times, but the resistance is increased sixteen times.

If, however, the bow be lengthened,





we shall have a reduction in that proportion of the plus pressure; for, if with 20 feet per second speed and 20 feet of half breadth, the bow be 20 feet long, the outward velocity necessary to be given to the water in its passage from *a* to *b*, fig. 2, will be only 20 feet per second; and if the bow be 40 feet long, the requisite velocity will be only 10 feet per second, consequently the power may be reduced in proportion as the bow is lengthened; and as the resistance which the water offers to rapid motion from before the vessel, is the main element in the total resistance, no available power will be sufficient to drive a vessel beyond a certain speed, unless the bow be long in proportion to the speed required; nor does the question of economy terminate with the length of bow, for its form must also be good—such that each section, supposing it so divided, should impart motion to the water uniformly; for the more uniformly motion is imparted, the less power will be required to effect it.

Attention must be paid also to the form of the after body, else the minus pressure will be unnecessarily reduced and further power absorbed.

Colonel Beaufoy found that a globe requires 64 lbs. to move it at a given velocity, but when this was cut in halves, and a cylinder inserted between them, it only required 46 lbs. to move them at the same rate; this would arise from the circumstance of the outward current of water from before the globe preventing the flow of water in behind, by which the minus pressure was reduced to very little; but, on the insertion of the cylinder, time was given for the return of the water in behind, from which the minus pressure was kept up.

If we suppose the case of a vessel with a bow 20 feet long, and at a speed of 20 feet per second, the water, when it has arrived at the termination of the bow, will have a velocity of 40 feet per second, and instead of turning in behind the vessel, will continue to flow outwards

while the vessel passes ahead; and when it does turn in, it will be only with a retarded velocity that is due to the force of gravity—consequently, minus pressure can be obtained from this water only after two or three seconds, or not until the vessel has moved on 40, 50, or 60 feet, as it may be; therefore there should be a straight of equal breadth, and of proportionate length, to the distance she then moves, behind the bow and before the curve of the after body; then it is obvious that the more full the after body, the greater will be the onward push derived from the resolved thrust of the water flowing in, wherefore the greater will be the minus pressure.

Great fulness is admissible, as the water will flow in with great rapidity; at a depth of 16 feet, it acquires a velocity of about 32 feet per second; below that greater, and above it less, varying as the square of the depth.

Doubtless there are interfering currents, so we cannot affirm positively what is the exact velocity; but these arguments will suggest the most useful experiments.

I am, Sir, yours, &c.,
E.

THE LOST ARCTIC EXPEDITION.—HINTS FOR THE BENEFIT OF THE FORLORN HOPE.

Sir,—As you did me the favour to insert in your Magazine my communication of the 20th of November last, in reference to the contemplated search for Sir J. Franklin and his gallant companions, I now beg to send you a few other suggestions in connection with that subject, which, if on trial they should be found to answer the purpose, would not only tend to the comfort, and possibly to the preservation of the intrepid voyagers who may venture upon this perilous mission, but also add greatly to their power of action in those chilly regions where the extreme cold must almost paralyze exertion. There is every reason to believe that the cold would be found much more intense in the higher portions of the atmosphere than any degree yet experienced by civilized man: to counteract its effects, therefore, would be a matter of additional importance, supposing it should be thought advisable to put to the test the æronautic experiments which I suggested in my last letter, particularly if attempted during the winter season. I propose, by means which I shall presently explain, to surround each person about to be so exposed with an artificial atmosphere, kept constantly heated to about (say) 60° of Fahr., or any other required temperature, so as to render such person almost as comfortable and capable of action as if in a well-warmed apartment.

I first form a quantity of cellular cloth, by sewing a certain thickness of wadding or padding between two pieces of common cotton lining, and also another thickness of wadding between two other pieces of lining of similar size. Then, on one side of each of these pieces, I sew thereto a piece of Mackintosh or other waterproof material, and form a series of cords of wadding, each about half-an-inch in diameter, and of equal lengths, and covered also with cotton cloth. Next, I sew these cords in parallel lines longitudinally, about three-quarters of an inch apart between the pieces, leaving the waterproof material on the outside.

By this means, a series of cellular passages would be formed through the whole length and breadth of the cellular cloth, at one extremity of which I would form a transverse passage or cell of larger dimensions for uniting the several longitudinal cells together (being precisely similar in construction to my patent cellular metallic plates, which have for several years past been in constant use for numerous heating purposes, only that in this case there will be no necessity for a transverse passage at the opposite extremity, for reasons which need not here be explained.) Now, supposing a sufficient quantity of pieces of cellular cloth to have been so prepared, I then propose that it should be formed into great coats or wrappers, overall trousers, &c., the collars of the coats and upper portions of the trousers to have the transverse (annular) passages therein, from which the longitudinal cells would run downwards to the extremities of the coat sleeves and skirts, and also to the lower parts of the trousers, where, at the ends of every cell, there might be formed small apertures to allow of the escape of any superabundant air when propelled through the cells. A head-piece or helmet may also be formed, if necessary, on a similar cellular principle, and of light materials, some-

thing similar in shape to a fireman's helmet, with a small frame, properly glazed, fitted into the front, so as to enable the wearer to view objects without having his face exposed to the weather. The frame of the helmet should be so made as to be readily opened or closed, or the whole helmet lifted off the head when desirable. In the next place, to produce an adequate supply of heated air, and to propel it uniformly through the several cells, I propose that each individual, when properly attired in his cellular over dress, should have fitted around his waist and body just outside his waistcoat, a hollow spring belt, the interior of which should be connected by means of elastic tubes (containing outlet valves), with the transverse (annular) passages of the coat or trousers, and (if required) with the top of the helmet, and also connected centrically with a hollow breastplate (by means of an inlet valve), properly supported and attached to the wearer outside of the cellular dress by braces, straps, &c., and so formed as not to press prejudicially upon the hollow spring belt. The hollow breastplate should also be connected by means of tubes, to the top of the outside casing of a pair of small light tubular lamps or lanterns, connected to and supported by a strap running round the body of the wearer, just above the hips, for containing candles, on the same plan as carriage-lamps, but each surrounded and almost covered over—merely leaving room for the escape of smoke (if any) by two outer casings, the inner ones to contain about a pint of water each, and the outer ones to be well surrounded by non-conductors of heat, and for allowing currents of air to pass through, and thereby to become heated; and passing from thence, as required, by means of the tubes, to the double breastplate, to which also another tube should be attached, for the admission of cold air. Stop-cocks should be fixed, for enabling the supply of each to be regulated and proportioned, so as when mingled together to produce the exact temperature required. Now, supposing a person fully equipped in his dress, the stop-cocks properly adjusted, and the candles in the lamps lighted, the operations of heating and propelling the air through the various cells would immediately take place, and be continued without intermission, by the natural expansion and contraction of the chest of the individual in the act of breathing; which would, in the first place, by its expansion, cause the elongation of the hollow spring belt, and consequently the admission therein of a certain quantity of warm air through the inlet valve from the hollow breastplate, and in the second place, by its contraction, cause the shortening thereof; and the consequent expulsion therefrom of the warm air (so admitted) through the tubes and inlet-valves and various cellular passages of his dress, and ultimately out of the small apertures at the ends of his coat sleeves, coat skirts, and trousers, as well as through the lower edges of his helmet, and so on continuously. Every portion of his body and limbs would be protected from cold by the intervention of a genial atmosphere. By proper woollen gloves and stockings connected with the garments, the feet and hands might also be protected, the warm air passing through the interstices thereof. Warm and pure air might also be supplied for breathing by similar means, should the caloric evolved from the inside and edges of the helmet and transverse (annular) passage of the coat collar, when buttoned up close around the neck, not prove sufficient for warming the air inhaled.

I may be allowed, perhaps, to remark, that the mode herein detailed for conveying heat to the various parts of the human frame has considerable analogy to that produced by the circulation of the blood by the action of the heart; the elastic hollow belt serving as a species of heart-pump for propelling the fluid air through the various ramifications of the dress to the very extremities thereof, which might, if thought proper, be even (more economically) returned again through the lamp, or lungs of the apparatus, to acquire a fresh dose of caloric; but which, for simplicity's sake, I allow to escape, as the quantity of heat lost in this case would be very trifling, its admission being capable of being regulated to the greatest nicety. Should, however, any difficulty arise in using the continuous and almost, as it were, self-acting motion of the chest to keep up an uniform flow of these currents of warm air, I propose, in lieu thereof, to use a small fan-wheel, working horizontally within a case fixed upon the breastplate,

which should receive the moisture of the cold and heated air at its centre, by means of tubes, stop-cocks, &c., and should propel the same from its circumference through the other tubes and cells of the dress; the flow being regulated as before. I would keep the fan-wheel in constant action, by multiplying gear, actuated by a spring, to be wound up occasionally, say once in every hour. For short periods of time, however, the cellular dresses might be kept heated by having hot water only, contained in double vessels of tin, like small milk cans, capable of containing in their central portions about a quart. I merely mention this substitute for the lamps, supposing they might be considered dangerous when used in the cars of balloons, should such a mode of making observations be ever put in practice. I hope I have described my proposed method of protecting the Arctic adventurers from the baneful and paralyzing effects of excessive cold with sufficient clearness to enable any competent artisan to carry out my suggestions. I will only now add that the lamps, one or both, might be rendered easily separable from the other apparatus by conical stopper joints. When detached, the lamp might be found extremely useful under certain circumstances for boiling water, for making coffee, tea, or soup, or even cooking a chop or steak, as well as for lighting a person on his journey through these dreary regions during the dark portion of the year. Indeed with a few pounds of candles and the nourishing extracts before alluded to, a man might, under a pressing emergency, travel, and support himself for many days together, instead of being unable, as at present, to exist as many hours when exposed to a driving wind with the thermometer probably from 50° to 80° below zero; which temperatures appear, by the statements of former travellers, to be by no means unusual near or within the Arctic circle. Even in this mild climate, a cellular great coat, or dress, so heated, I should imagine would not be objected to by a railway guard, steamboat captain, or steersman, or others necessarily exposed to the weather for many hours together during inclement winter—and particularly policemen during their night patroles, whose lanterns, slightly modified, might be used for the purpose of affording them this healthy luxury.

I am, Sir, yours, &c.,

W. H. James, C.E.

December 27, 1849.

## CONTRACTING OF ELECTRIC WIRES—IMPROVED INSULATORS.

Sir,—In your Magazine of last week, No. 1377, Mr. Gilbert, in answer to my letter, suggests, that "if each wire had a kind of spiral twist, at proper distances apart, it would expand or give way sufficiently to counteract the contraction of the metal." Mr. Gilbert is probably not aware that the wires wind up only twice in every mile, and that the wire (No. 8, not No. 1, as printed in No. 1376) being one-sixth of an inch only in diameter, the twist would not bear the strain on it, about three hundred weight.

In my former letter I mentioned that a new kind of bell insulator had lately been invented.* I now send you a rough sketch of it. The scale is about one-third of the natural size.

Figs. 1 and 2 and the two sections figs. 1a 2a will, I think, be sufficient to show the principle of this insulator.

The shaft E C is not made round, as in Mr. Ricardo's bell cone (fig. 3), but of the shape A B, shown by the section at *c d;* the space C at the end of it is sufficiently large to enable the top of the hook (which top is made of the same shape at the section of the shaft) to turn round in it; the notch D C (section *a b*) is at right angles to the shaft, and of the same shape, but only about three-sixteenths of an inch deep; so that when the hook has been pushed up the shaft, it is only necessary to give the insulator a quarter of a turn, and the top of the hook will lock itself into the notch D C, and be kept there by the weight of the wire.

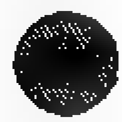
Fig. 3 shows the insulator of Mr. Ricardo's patent, which I described in my former letter; the hollow D is that which has to be filled up with cement as

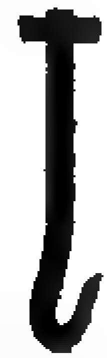
* By A. Spowers, Esq., Signals Superintendent, Central Station, Lothbury. This gentleman has kindly furnished us with a sketch of his insulator, for your Magazine.

Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Fig. 1.

Fig. 2*.





mastic when the hook has been screwed up.

Fig. 5 shows the hook of the improved bell cone.

I find that the first idea of the bell insulator is due to Mr. Alexander Bain, to whom electro-telegraphy owes so many valuable inventions. He used, about five years ago, a bell-shaped insulator, of which I believe fig. 4 to be a section; in this the wire was not suspended from the earthenware by means of a hook, but was looped round the top B, and the insulator itself was supported on a piece of wood or iron which filled the hollow A.

I am, Sir, yours, &c.,

THEODORE G. A. CHESNEL.

Hampstead, January 1, 1850.

## GREAT SUSPENSION BRIDGE IN RUSSIA.

Considerable interest has been excited in St. Petersburgh by a remarkable model of a suspension bridge across the river Dnieper, at Kieff, one of the principal cities of Russia. This model was made in London, where it was exhibited to most of the principal engineers and architects. It has since arrived in St. Petersburgh, and has been put up in one of the grand saloons of the Winter Palace, where it was formally presented to His Imperial Majesty on his *fête* day, the 6th (18th) of (December), by Mr. Vignoles, the English engineer, from whose designs, and under whose immediate directions, this bridge is now constructing.

The Dnieper is one of the largest rivers in the Russian empire, rising in the vicinity of Smolensko, and flowing in a southerly direction it enters the Black Sea, to the eastward of Odessa. In a broad geographical sense the Dnieper may be considered as the cantonment boundary between Russia Proper (or Muscovy) and the great kingdom of Poland, which once extended westward nearly to the Giant Mountains of Bohemia, southward to the Carpathians, and northward to the Baltic. The principal city entered by the Dnieper in its long course to the sea is Kieff, celebrated in history as the first spot whereon Christianity was planted among the barbarous hordes then leading a nomadic life over the steppes of Russia, is well known also as an important military frontier post, alternately possessed by the Poles and by the Muscovites, and at present rising into great importance as the capital of the south of Russia.

Kieff is most picturesquely situated on the right or southern shore of the Dnieper; it covers a great extent of space, with numerous public buildings crowning the many heights of the undulating ground on which the city is built. The general aspect of the city is very striking, and the impression on a traveller from the western parts of

Europe is that which he would expect to receive on first viewing some Asiatic capital. The commercial part of the town, called the Podol, lies on a low plain at the western extremity; the rest of Kieff is elevated from 200 to 300, and even 400 feet above the level, overlooking all the left or northern shores of the Dnieper, which are low and flat marshes, extending for many leagues above and below Kieff, and from one to two leagues wide. In the spring the whole becomes a lake, as the waters rise, and the only approach from the north to Kieff is along a causeway raised above the level of the floods. It is from the end of this causeway that the suspension-bridge is thrown across the Dnieper to the foot of the steep acclivities on the right bank. The river, which, for several leagues above, has spread through numerous lateral channels, here unites into one deep bed, and presents the narrowest passage. This passage is, however, still half an English mile in breadth, the depth of the water, in a dry autumn, being upwards of 30 feet in the streamway, and sometimes more than 50 feet after the melting of the snow in spring. Over this chasm, which once formed the barrier for Poland against the invasion of the Moscovites, the necessity of internal communication and the general march of improvement has called for the erection of a permanent bridge, and with enlightened policy the Emperor of Russia has ordered such a bridge to be constructed.

The soil of the bed of the river being wholly of sand, and the current often changing its channel, considerable difficulties presented themselves, while the tremendous breaking up of the ice after winter, followed by the melting of the snows in the more northern districts, swelled the stream to an extent scarcely comprehensible to the inhabitants of Great Britain. It became, therefore, a necessary condition that the number of piers of any bridge to be built there should be the fewest possible, with the largest openings between them. Hence it seemed most natural that, with the given limit of expense, the principle of a suspension bridge should be preferred, and the designs were so prepared accordingly, and submitted to His Imperial Majesty. On Mr. Vignoles' urgent recommendations, the use of wire ropes as the means of suspension was negatived, and the adoption of wrought iron chains with broad flat links was decided on. Such was the system employed for the Menai and Conway Bridges in Wales, by Telford, at several places in England, and also in Hungary, at Pesth, across the Danube, by Tierney Clarke. All these bridges, however, have but one central opening. The suspension bridge at Kieff has four principal openings, each of 440 feet, and two side openings of 225 feet each, and also a passage of 50 feet on the right shore, spanned by a swivel bridge, opening for the passage of the steam-boats and other river craft. There are, therefore, five suspension piers in the river, one mooring abutment on the left bank, another mooring abutment on the Kieff side of the stream (which, on account of the passage for boats beyond it, is actually an island of masonry in the river), and an abutment for the swivel bridge on the right bank. Each of these have required a coffer-dam of unusual size—particularly the two last mentioned. The architecture of the river piers is rather novel, and of a striking character, harmonizing with that used in the extensive range of first-class fortresses which crown the heights of Kieff. The ways through the piers have a clear breadth of 28 feet, and a height of 35 feet to the soffit of the semicircular arches. The platform has nearly 53 feet of extreme breadth, of which 35 feet are exclusively devoted to the carriage way; the platform is suspended by chains, all on the same horizontal plane, two on each side of the road; the footpaths project beyond the chains, and are carried by cantilevers round the piers exteriorily, so that the foot passengers are completely separated from the horsemen and carriages. The chains are composed of links 12 feet long, and each weighing about 4 cwt.—eight links form the breadth of each chain, and the total length measured along their curves being about four English miles. For the swivel bridge the iron employed is almost exclusively malleable; the breadth of the platform is nearly 53 feet, and the weight of iron employed scarcely exceeds 100 tons. The bridge is moved horizontally (on the same principle that locomotive engines are sent round on the large turntables at a railway station), and by the efforts of four men only, acting on a very simple apparatus. The construction of the platform of the bridge presents several novel combinations of wood and iron, and is of extreme stiffness, to resist the violent action of the eddies of air in violent winds, which have so often injured, and even destroyed, the ordinary platforms of suspension bridges in other places. The balustrade is remarkably light and elegant, in ornamental pannels of wrought iron. Indeed, cast iron has been carefully excluded from every part of the whole bridge, except where its use was really preferable or absolutely unavoidable. The total weight of iron used in the construction of the bridge is about 3,300 tons, including the machinery used in the various stages of its construction. The whole was made in

England, several of the most celebrated iron-masters and manufacturers having been engaged upon it. It required fifteen vessels to bring the iron to Odessa, whence it was taken up to Kieff in small wagons drawn by oxen, over the wild steppes, almost without roads, or none that deserve the name.

The quantity of machinery of every kind employed in the construction of the Kieff bridge is most enormous, and not less than nine steam engines are in use. Two of these are large stationary ones, each capable of working up to a power of 50 horses; the rest are from four to eight horses power, and can be moved about as required. These engines pump water, drive piles, grind mortar, hoist timber, iron, &c., draw loads, and perform a variety of other operations, in substitution of manual labour.

A temporary bridge, carrying a railway, has been thrown across the whole breadth of the Dnieper, and is connected by a self-acting inclined plane with the heights of Kieff, whence the great blocks of granite and masses of iron are sent down from the depôts above to the works on the river. The great provision of granite, bricks, timber, cement, lime, field-stones, &c., is very extraordinary, covering many acres of ground. A whole village of warehouses, offices, shops, sheds, dwelling-houses for the superintendents, and comfortable cottages for the numerous workmen, have been erected on the left bank of the river, on ground expressly raised for the purpose above the flood level. A regular commissariat is attached to the establishment, and the whole organization of service is very complete. The bricks employed are very hard, and of a beautiful pale colour. Extensive quarries of granite were opened in a great many places, solely for these works, but the principal supply and the largest and finest blocks are found nearly 100 miles from Kieff, and are brought thither on bullock-carts, through a rough country, destitute of roads. Not the least remarkable part of the establishment is that for the manufacture of the hydraulic cement required for the foundations and masonry. It is, in fact, an artificial pozzolano, made from a peculiar clay found in the Kieff hills, and prepared on the principles laid down by the celebrated French engineer, Vicat, in his recent publication. The buildings for this purpose are very extensive, being gigantic laboratories, where the operations are carried on day and night. Eight large roasting ovens, besides numerous grinding mills, are in constant action; the quantity manufactured is upwards of 300 bushels (or about 500 cubic feet) in every 24 hours.

It must be reserved for a technical publication to enter into all the engineering details of construction of the Kieff bridge, as there can only be given here a merely general idea of the principal features of this very magnificent bridge, which will be the largest in Europe, the length being fully half an English mile, and covering an area of 100,000 square feet, being considerably more than three acres. The works were first commenced in April, 1848. The ceremony of laying the first stone took place in September of the same year. Eight large coffer-dams were completed by the early part of 1849; two of these having been destroyed or damaged by the spring floods, have since been entirely reconstructed. The foundations of the abutments and of two of the river piers were safely got in before the winter began, and all the foundations and coffer-dams have been secured by an extensive system of protecting works of *mattrasse-nascines*, laid down according to the modern practice in Holland, by Dutch contractors brought purposely to Kieff by Mr. Vignoles. It is expected that the whole of the masonry will be completed by the end of the season of 1850, and that in the course of the autumn of 1851, the Kieff suspension bridge will be finished and opened.

The causeway approaching the Dnieper from the northward, as before mentioned, having been greatly damaged in the great floods of 1845, will be put into sufficient repair for the roads on the left bank of the river. On the right bank, a fine new road along the shore at the foot of the acclivities leads up-stream to the commercial and other parts of Kieff, and down-stream to the present ferry and the lower fortresses. Another road will be formed ascending to the great military positions on the heights above.

The beautiful model of this remarkable bridge is on a scale of about 1·100 of the length of the actual work. It is the most perfect thing of the kind, probably, ever designed or executed, and reflects the highest credit on Mr. James, of London, the modeller, and his chief assistant, Mr. Sims, who, with another engineer, came purposely from London to erect the model at St. Petersburgh. Every piece of wood or iron, every bolt, screw, and plank—and they are there by thousands—is represented in miniature and in the most perfect manner; the architectural details of the masonry, the interior arrangements of the abutments, the moorings, and saddles of the chains, the machinery of the swivel-bridge—all are faithfully represented on the proper scale, and in due proportion. The proportionate scale of length being as 1 to 100, that of area is of course as 1 to 10,000, and that of cube as 1 to 1,000,000! and all the smaller pieces of iron are accurately put into the model in the

latter proportion. The stand for the model is of mahogany, supported on bronze Ionic pillars, with gold capitals and frieze, forming a splendid piece of furniture, worthy even of the Imperial Palace. The water of the Dnieper is represented by a mirror, which reflects the under side of the platform, and the whole model is covered with a splendid glass-case, set in a gilt frame, with a beautiful dome of glass, supported on richly gilt pillars of the Corinthian order; the whole exquisitely chased. The model and stand have required two years to make, and the expense, from first to last, has been fully 6,000*l*. sterling.

The cost of the Kieff suspension bridge, exclusive of the approaches, will be upwards of 400,000 guineas—say about two millions and a half of silver roubles of Russia, and nearly 11,000,000f., which, though large in amount, may be considered a very low price for so large a work. Mr. Vignoles has already prepared, by command of the Emperor, designs for several other large bridges in various parts of Russia. Some of them have been approved, and others are still under consideration, and designs are in various stages of progress for still more bridges, besides other works; for all of which the iron must be furnished from the English manufactories.—*Times.*

## DIXON'S PATENT LIQUID MEASURES.

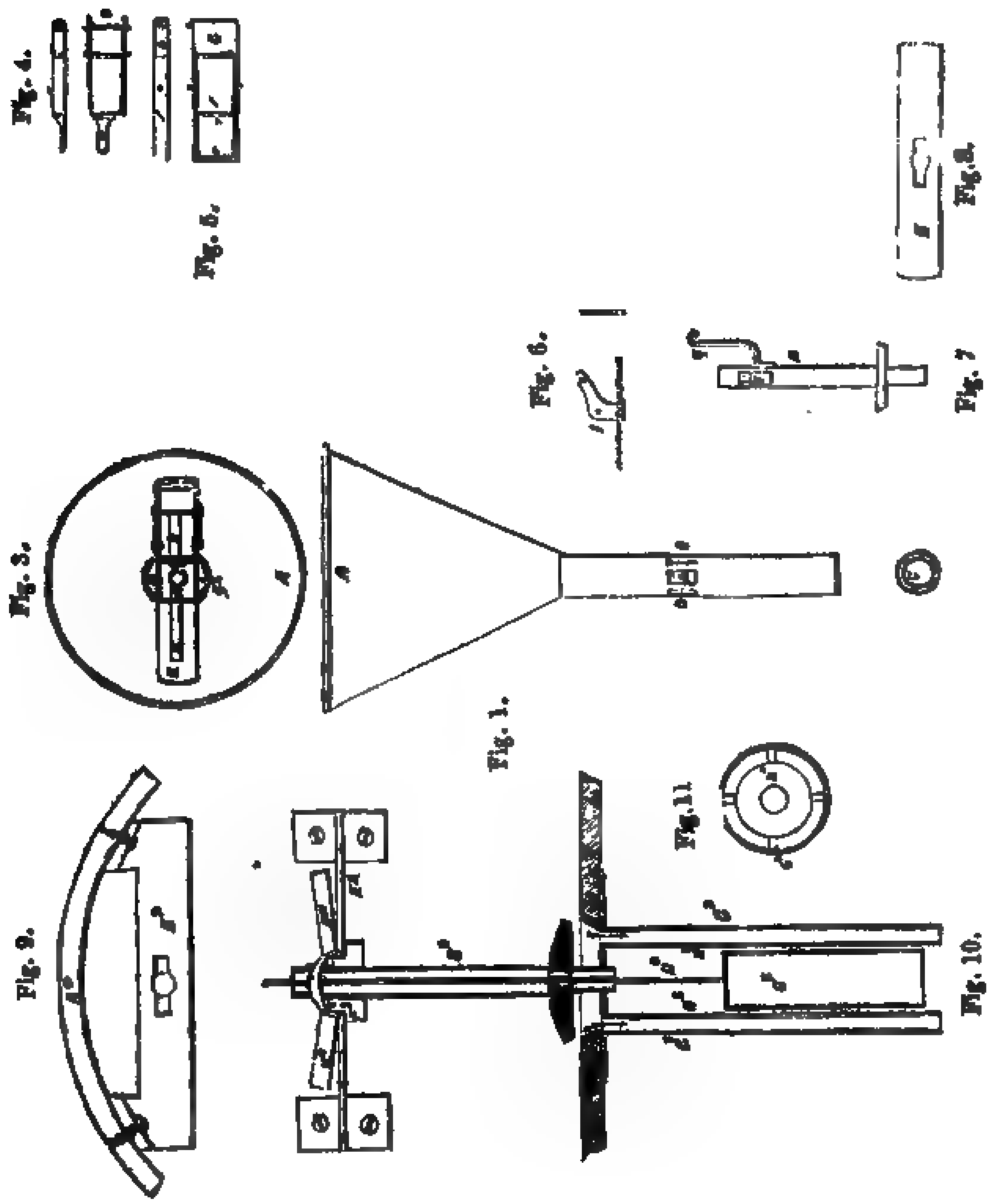
We give now, as promised (last vol. p. 617), the details of this invention, patented in the name of Mr. Brooman on behalf of our esteemed friend and correspondent, Mr. Job Dixon of Brussels.

Fig. 1 represents Mr. Dixon's improvements as applied to a funnel for filling bottles. Fig. 2 is a vertical section, and fig. 3 a plan of the same. A is the funnel; B, the valve tube; C, a light float, which may be either open or closed at bottom; D, float spindle rod; E, cross plate, shown separately in plan in fig. 8. F F are stop pieces, fixed to the valve tube B; H, a flat lever, shown detached in fig. 4; J, wing lever, with cross pieces *r*, *r*, which is weighted at one end G, as shown in fig. 5; I, a support fixed to the cross plate E, and shown detached in fig. 6. K K are wings hinged to the upper part of the stop pieces F F; L, a valve of any convenient kind attached to the tube B; *m*, *m*, links which connect at each side the levers H and J; N, a cone which is fixed inside the funnel pipe, and has a small hole at its apex, for the free passage of the float spindle D. To facilitate the flow of the liquid through the funnel, there are several openings in the funnel pipe, as shown at *o*, *o*. P is the valve seating; *q*, wire handle for lifting the tube B, with its valve L, as shown in fig. 7. All these different parts may be made of tin, or in any other suitable material, and of any convenient size.

The action of the funnel is as follows: when the tube and valve are ready for action, as represented in fig. 2, in which case they are supposed to have been lifted up till the stop pieces F F touch the cross plate E, and allow the wings K K to fall into the position shown, where they are held by the cross pieces *r*, *r*, in the wing lever J, and thus keep the tube B, with its valve L, suspended. The wing lever J being hung midway in the support I, and being connected by the side links *m* to the float lever H, they thus act in unison. The lever H being hung in the same support I, at about one-fourth of its length from the link end, it follows that the leverage thus gained, together with the weight of the float and its spindle, is sufficient to keep the cross pieces *r*, *r*, of the lever J between the wings K K, as shown. But as the liquid rises in the vessel and into the funnel pipe, the float being immersed in the liquid, loses weight, allowing thus the weighted end G of the wing lever J to preponderate and detach the wings K K, whereupon the valve falls into the seating P, and thus cuts off the supply of liquid to the vessel. The required height to which the liquid is to be raised depends on the length of the funnel pipe, as found by trial, and the weight the float has to overcome; for this latter purpose small screw nuts, as shown at R, may be adopted, and thus add or diminish the pressure on the end of the float lever H.

For filling large vessels, such as barrels, &c., the apparatus may be fixed in any part of a filling tub, or other vessel; but I prefer fixing it to one side of the tub, as shown in fig. 9, where $A^2$ is a part of the tub, to the side of which is made fast the cross plate $E^2$, and through which the upper end of the valve tube $B^2$, with stop pieces $F^2$, and their wings, are allowed to pass. Fig. 10 is a vertical section of this apparatus; *a* represents the bottom of the filling tub; $B^2$, valve tube; $C^2$, float; $D^2$, the float rod; $E^2$, cross plates; $F^2$ $F^2$, stop pieces, to which are hinged the wings $K^2$ $K^2$; $G^2$, inlet pipe, with flange secured to the tub, either inside or outside. This pipe is made of the requisite size, to be inserted through the bung-hole or aperture of the vessel to be filled. $H^2$ an inner pipe, closed at the upper end, and connected at both ends to the inlet pipe $G^2$ by a few small cross stays, as shown in fig. 11. Thus a good space between the pipes $G^2$ and $H^2$ may be given for the descent of the liquid into the vessel, as shown by the arrows. $I^2$ is a

small cross head, screwed on the float rod $D^2$, which serves to keep the wings asunder and the valve suspended during the inflow of the liquid into the vessel; but when the liquid rises into the pipe $G^2$, the float being acted upon, the cross head $I^2$ is detached, and the valve $L^2$ falls into the seating $P^2$. This method of detaching the




wings may be considered as more simple than that described for the bottle funnel; but it has been found in practice that the small diameter of the float in this case has not sufficient buoyant power to detach with the required certitude the cross head $I^2$ from the wings $K^2$ $K^2$: but for filling larger vessels, the size of the float may be increased so as to remedy that defect.

For claims, see vol. ii. p. 617.

THE PRIZES AWARDED FOR PORTABLE STEAM ENGINES AT THE NORWICH MEETING OF THE ROYAL AGRICULTURAL SOCIETY.—REPLY OF THE JUDGES TO MR. BADDELEY.

Sir,—In reply to the letter of Mr. Baddeley, inserted in your Magazine of Saturday last, Dec. 29, we beg leave, as the judges of steam engines at the Norwich Meeting of the Royal Agricultural Society of England, to assert that, in awarding the prizes, our judgment was influenced by *no one*, and that the awards were given *solely* upon the *performance* and *merits* of the engines on trial.

Had your correspondent, Mr. Baddeley, waited until the reports of the judges of implements had been published in the Society's *Journal*, he would then have had a table of results, from *actual trial*, to have guided him in saying which engine should have stood first, instead of compiling a table from the Society's *catalogue*, the elements of which were many of them only the *opinions* of the *exhibitors*.

Again; we cannot see the "TRICK" by which Messrs. Wilson's engine, exhibited by Messrs. Randsomes and May, "was got rid of," as this engine, at the request of the exhibitors, was put through *two* trials, which perfectly satisfied them as far as we were concerned. This engine had a tubular boiler, in common with many of the others which had been tried before it, and all of them burnt coal. As to the letter which appeared in the *London Letter Bag* of Nov. 10th, it is a complete fabrication, and unworthy of notice. We have REASON to KNOW that the engine taking the chief prize was made *by the exhibitors, Messrs. Garrett and Son, at their works, Leiston, Suffolk.*

In the Society's printed instructions, it will be seen that the decision connected with the trial steam engines, rested solely with the two judges of the same, and only in case of their disagreeing, was the consulting engineer to be called in. We hereby declare that our judgment in awarding the prizes was *unanimous*.

Begging you will insert this letter in the forthcoming Number of your Magazine,

We are, Sir,

Your obedient Servants,

WM. N. PARSSON,
Southwark,
CHAS. JOHN CARR,
Belper, Derby.

Jan. 2, 1850.

*On the Same, from Mr. Garrett.*

Sir,—Your last Number of the *Mechanics' Magazine*, dated the 29th ultimo, contains a letter, from Mr. Wm. Baddeley, relative to the prizes awarded for steam engines at the Royal Agricultural Society's Meeting at Norwich, in which he asserts that the engine for which I received the principal prize of 50*l*., was manufactured by Messrs. Easton and Amos, the consulting engineers to the Society.

I hasten, without a moment's loss of time, to give a most unqualified contradiction to this assertion, which is as devoid of truth as discreditable to the parties who have given rise to it.

The steam engine for which I received the first prize of 50*l*., at the Norwich meeting, WAS NOT manufactured by Messrs. Easton and Amos, of London; but was made in my own workshops, at Leiston, by my own workmen, and under my own and my son's superintendence. Such being the case, *I am, of course, in a position to prove it*, BEYOND A DOUBT, which I shall be most happy and willing to do, to the President of the Council of the Royal Agricultural Society, or to any other person or persons whose respectability may entitle them to such attention.

The motive which has prompted such a proceeding, and the source from which it has originated, will be discernable to every reader of Mr. Baddeley's letter, and, as such unworthy of remark. I will only add, that the whole is a gross fabrication, from beginning to end; emanating, beyond a doubt, from some less successful exhibitor than myself; and although fully satisfied of the justness of my own position, I feel that thus much is due from me in vindication of the character of the gentlemen whose reputation has been so disgracefully assailed; and I shall be obliged by your inserting this letter in your *next* publication.

I am, Sir, yours, &c.,

RICHARD GARRETT.

Leiston Works, near Saxmundham, Suffolk,
January 2, 1850.

[Mr. Baddeley will, no doubt, feel called upon to explain the grounds on which he brought the serious charge referred to in the two preceding communications; and we trust he will be able to do so satisfactorily. If he has been betrayed by the misrepresentations of others into making our columns the medium of an act of injustice (which we take to be the fact), he knows well that he can do nothing more consonant with our uniform rule of conduct in such cases, than to make us the medium also of the most prompt and ample atonement.—ED. M. M.]

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 3RD OF JANUARY, 1850.

BRAM HERTZ, of Great Marlborough-street, gentleman. *For improvements in and additions to fountain pens.* Patent dated June 30, 1849.

The object of these improvements is threefold: first, to enable fountain pens to be used for a greater length of time, without replenishing, than the best of this favourite class of instruments are at present capable of being; second, to make the interior parts easier of access for purposes of rectification or repair when they get out of order; and third, to combine with the means for writing unintermittingly, the means also of using the instrument as an ever-pointed pencil. We do not set much store on the third of these objects, but the two others are of real importance, and carried out by Mr. Hertz in a most ingenious and effectual manner. The "fountain," or ink reservoir, is supplied as usual, by means of a piston acting on the principle of exhaustion; but the piston rod is worked by a separate screw rod with thumb-piece attached, which enables the user to actuate the piston with a degree of nicety of which no other fountain pen that we know of is susceptible. Again; the parts of the instrument are so connected together by a locking-piece, that the mere pressing back of a lever disconnects the whole, and thus admits of every needful repair being made.

*Claims.*—1. The improved fountain pen described, in so far as regards the manner of combination of the piston, the piston rod, the screw rod by which the piston is worked, and the locking-piece by which all the parts are connected together.

2. Several modifications of the preceding.

3. The combination in one instrument of a fountain pen and ever-pointed pencil.

JOHN THOMAS FORSTER, Plymouth, master in Her Majesty's Navy. *For improvements in the building of ships, boats, and other vessels; "also, in the manufacture of boxes, packing-cases, roofs, and other structures requiring to be waterproof."* Patent dated June 27, 1849.

The patentee, who disclaims the portion of his title within the inverted commas, states, that his invention consists in covering the planks used in ship or boat building with sheet gutta percha. For this purpose he takes the planks, as they are sawn, an coats them with a waterproof cementd caoutchouc, or gutta percha solution, on, which he lays the sheet gutta percha—having previously heated the under surface by the application of a blast of hot air, or otherwise, in order that it may adhere; and then applies pressure.

He proposes, also, to bevil the edges of the planks, so that they may lap one over the other, and to coat the points of junction with a waterproof cement. And, lastly, to cement thin planks together, by the interposition of sheet gutta percha between them, whereby, he states, they will be less liable to splinter.

*Claim.*—The application of planks or boards of wood, coated with gutta percha, or gutta percha combined with other materials, to the building of ships, boats, and other vessels.

THOMAS BEALE BROWNE, Hampers, Gloucester, gentleman. *For improvements in looms, and in the manufacture of woven and twisted fabrics.* Patent dated June 29, 1849.

The patentee describes and claims—

1. The employment of a wedge-shaped rod of wood or metal, which is introduced between the warps, for the purpose of forming a clear shed, and actuated by the batten; and, also, a method of shortening the stroke of the batten, for driving the distance to which the weft is to be driven.

2. A mode of introducing, in a similar manner, by power, rods of a wedge-shaped form, in the manufacture of one or more tubes, simultaneously, with or without the combination of gutta percha.

3. A mode of manufacturing sacks or bags, by which the bottom is made much sttonger than the rest, and the lips formed by the introduction of two shuttles—the bottom being sewed together by changing the tye—and the bag made perfect by these means, only requiring to be separated.

4. A mode of manufacturing belts or bands [by passing the threads through heated gutta percha previously to weaving them up, and afterwards subjecting the fabric to pressure, and dividing it into the requisite widths].

5. A mode of manufacturing rope [by passing the strands through heated gutta percha, and afterwards laying them together in the ordinary way].

EDWARD WOODS, Liverpool, C. E. *For certain improvements in turn-tables.* Patent dated June 28, 1849.

Mr. Wood's improvements consist in "constructing the skeleton or revolving top of turn-tables of a ring of malleable iron, to form the external bond, which rests upon suitable rollers, and is firmly united to two of the sets of rails, and combined with a central frame and pin."

*Electric Telegraph between France and England.*—The concession signed by the President, Louis Napoleon and the Minister of the Interior, M. Dufaure, granting to Messrs. J. Brett, Toché, and Co. the right to establish an electric telegraph line between France and England by a submarine communication across the Channel, arrived in town on Monday. The Company propose to establish, by means of the electric telegraph, an instant communication between the two countries. The patentee guarantees that this telegraph shall, by the aid of a single wire, and of two persons only (the one stationed in France, and the other in England), be capable of printing, in clear Roman type (on paper), 100 messages, of 15 words each, including addresses and signatures, all ready for delivery, in 100 consecutive minutes.—*Standard.*

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Louis Cesaires Charpillon, of Rue de Luxembourg, France, for improvements in locks for guns and pistols. December 29; six months.

John Read, of Park-terrace, King's-road, Chelsea, gentleman, for improvements in machinery for extracting fluids from animal, vegetable, and mineral substances, and in compressing the same. December 29; six months.

William Palmer, of Sutton-street, Clerkenwell, Middlesex, manufacturer, for improvements in the manufacture of candles, lamps, and wicks. December 29; six months.

William Barlow, of Blackheath, civil engineer, and William Henry Barlow, of Derby, civil engineer, for improvements in the permanent ways of railways. January 3; six months.

Albert Crackell Waterlow, of London-wall, lithographer, for improvements in the means and apparatus for obtaining copies of writings, drawings, and other designs. (Being a communication.) January 3; six months.

Alexander Brodie Cochrane, jun., and Archibald Slate, of Dudley, Worcester, engineer, for improvements in the manufacture of iron pipes or tubes. January 3; six months.

Thomas Lightfoot, of Broad Oak, within Accrington, Lancaster, chemist, for improvements in printing and dyeing fabrics of cotton and of other fibrous materials. January 3; six months.

William Buckwell, of the Artificial Granite Works, Battersea, civil engineer, for improvements in compressing or solidifying fuel. January 3; six months. To extend to the Colonies only.

Joe Sidebottom, of Pendlebury, Lancaster, manager, for certain improvements in steam engines. January 3; six months.

Henry Dorning, of Hearsley, near Bolton, Lancaster, brick and tile manufacturer, for certain improvements in machinery or apparatus for manufacturing bricks, tiles, and other similar articles from clay or other plastic materials. January 3; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Dec. 22 | 2128 | Bathgate and Wilson... | Canning Foundry, Liverpool ... | Metallic cask or vessel. |
| 27 | 2129 | John Meik and Henry Watson ............... | Sunderland ......................... | Signal-house. |
| 28 | 2130 | Augustus Smith ......... | Osborne-street, Whitechapel .... | Universal painters' brush. |
| ,, | 2131 | Westley Richards ....... | Birmingham........................ | Corkscrew. |
| ,, | 2132 | William Gordon ......... | Army and Navy Club, St. James's-square, London, Lieutenant R. N........................ | A pair of marine steam engines. |
| 1850 Jan. 2 | 2133 | John Lart and Son ...... | Wood-street, Cheapside........... | Elastic back-piece for cotton and other drawers. |

## CONTENTS OF THIS NUMBER.



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Mechanics' Magazine,
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1379.] SATURDAY, JANUARY 12, 1850. [Price 3*d.*, Stamped, 4*d.*
Edited by J. C. Robertson, 166, Fleet-street.

## BESSEMER'S PATENT CENTRIFUGAL DISC PUMP.

Fig. 1.

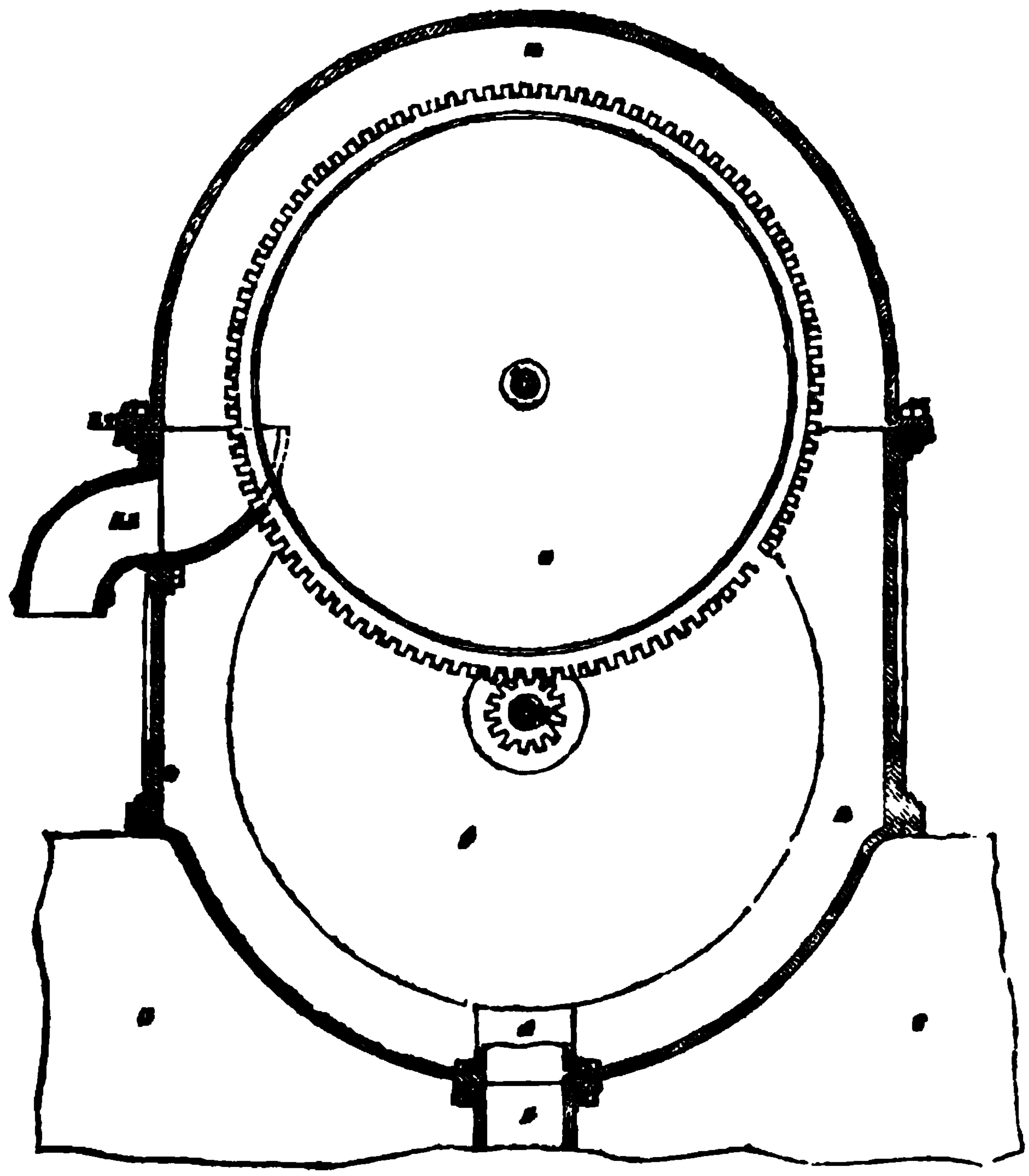
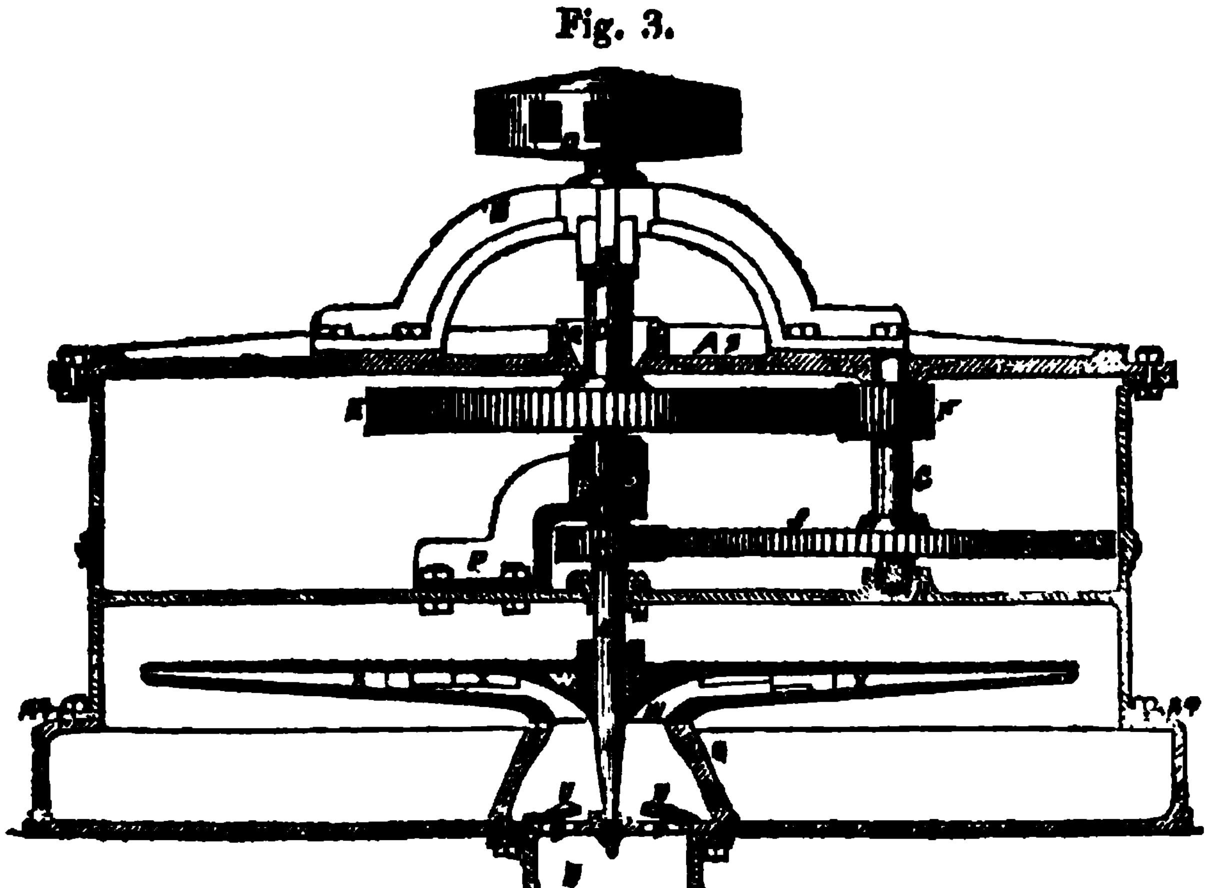


Fig. 3.



BESSEMER'S PATENT CENTRIFUGAL DISC PUMPS.

We have now to lay before our readers the details of the centrifugal disc pump, which occupies so prominent a place in Mr. Bessemer's last budget of new inventions (see last vol., p. 617). The pump is of three varieties; 1. A lifting or suction pump; 2. A forcing pump; and 3. A lifting and forcing pump.

## I. *The Disc Lift, or Suction Pump.*

Fig. 1 is a vertical section of this machine on the centre line.

Fig. 2 a longitudinal section on the line CD.

*a* is an iron case which is composed of two parts bolted together by a flange *a*, and rests on masonry, *c*, by a flange or base *a'*. The lower compartment of the case contains a disc, *f*, by the centrifugal action of which the water is raised; and the upper compartment contains the principal parts of the wheel-work by which the disc is put in motion. The lower compartment of the case communicates by a tubular angle piece, *d*, with a suction-pipe, *e*, which descends into the well or pit, from which the water is to be raised. The disc consists of two circular plates of metal, $f^1 f^2$, which are connected by a number of intermediate radial leaves, $f^3$; it is mounted on a shaft, *g*, which works in brass bushes, *h h*, let into projections, *i i*, cast on the sides of the case, *a*. In the outer ends of the brass bushes *g*, there are screw caps, *j j*, having elastic washers under the heads of them, by which any escape of water through these bearings is prevented. The plate $f^2$ has a boss on the centre by which it is attached to the shaft *g*, and the other plate, $f^1$, has a mouth-piece projecting from the centre, which is turned true, so as to fit as closely as may be, without touching, the mouth, $d^1$, of the tubular angular piece, *d*. The caps, *j j*, serve to adjust the distance between the orifices $d^1$ and $f^1$, by acting against the ends of the shaft *g*, and thereby causing the entire disc, *f*, to move nearer to or recede from the orifice $d^1$. On the shaft *g* there is a small partition, *k*, which gears into a large toothed wheel, *n*, keyed on a driving shaft, *l*, which passes out on both sides through the upper compartment of the chamber *a*, and has stuffing-boxes *m m*, and glands *o o*, to prevent the escape of water at these points. The wheel *n* is solid in the centre, instead of being divided into arms as usual. On the ends of the shaft *l* there are handles *p p*, by which the wheel *n* is turned, and motion thereby transmitted to the disc *f*. The lower end of the suction pipe, which descends into the well or other receptacle, is provided, as usual in common suction pumps, with a valve, to retain the water in the pipe when the pump is not in operation. The centre radial plates $f^3$ are made narrower at the ends furthest from the centre, whereby the space between the plates $f^1$ and $f^2$ is contracted in width in proportion as the space between the radiating partitions $f^3$ increases in breadth towards the circumference. The partitions are riveted between the two plates, of which the disc is formed. I have generally obtained a good result from discs, in which the area of the central mouth-piece was equal to the outlet of the periphery; but it will be found preferable in most cases to make the central opening larger and gradually diminishing, so that the area of the exit at the periphery may be one-third or one-half less than the inlet at the centre. The object of this arrangement is to prevent any loss of power which might arise from too much exhaustion in the centre, caused by the increased velocity of the motion of the water as it proceeds from the centre. The diameter of the disc may be considerably varied, so as to suit the speed of the first mover, or the height to which the water is to be raised. When the height is great, either the diameter should be increased or the speed must be increased; but the centrifugal disc pump, like the common pump, admits of considerable variations in its proportions to suit different cases; but it may be laid down as a general rule, that the area of the outlet should never exceed the inlet of the disc.

The mode in which the apparatus operates is as follows:—The suction pipe *e*, and both the compartments of the case *a* are first filled with water, and motion being given to the handles *p p*, the wheel and pinion cause a rapid motion of the disc *f*, when the water contained between the intermediate radial leaves $f^3$ acquiring a centrifugal force proportional to the velocity with which the disc is driven, will throw the

water outwards, and a sort of vacuum be formed in the centre of the disc, which, as fast as formed, is filled up with fresh supplies of water from the suction-pipe, and thus a continuous flow is kept up. The outer spout $a^2$ is placed so high as to prevent the water ever falling low enough in the case *a* to leave any part of the disc uncovered.

Fig. 2.

### *The Disc Forcing Pump.*

Fig. 3 is a sectional elevation of this form of the pump.

The case *a*, in which the disc revolves, is made of cast-iron, and has two short curved elbows, *b b*, which turn upwards, and are united by flanges to the branch pipe *c c*. To the upper part of the pipe *c c* a continuation of the rising main $c^1$ is joined, and the pipe *c c* is bent sufficiently backwards to allow the shaft *d* to pass down in a right line through the centre of the machine. On each length of pipe forming the rising main, a projection is cast, and formed into a plummer block to support the shaft *d*. The lowest of these plummer blocks is seen at *e*, below which the driving shaft *d* gradually tapers off, and passes through the central boss $f^1$ of the disc *f*, and terminates in an obtuse point at *g*, immediately below which there is a support *h*, which serves to support the end of the shaft when the apparatus is not in action. On the upper side of the chamber *d* there is a cover *i*, the centre of which rises in the form of an inverted cone $i^1$, through which the water to be raised finds its way into the revolving disc *f*. It is therefore necessary in this form of the apparatus to immerse it in the water so far, that the level of the surface of the water shall be about one foot above the mouth $i^1$ of the cover. The disc *f* is constructed like that before described, or it may be cast in one piece, the openings between the partitions $f^2$ being formed by cores, in a manner well understood by founders. The mouth of the disc $f^3$ should be turned so as to approach very close to the under side of the cover *i*, and thereby prevent any loss of water at that joint. The junction of the revolving disc with the inlet pipe may be secured by hempen or metallic

packing, or by a hydraulic leather; but as these packings are subject to rapid wear, and absorb power by the friction they occasion, I prefer to make the disc approximate as near as may be to the orifice of the inlet opening, and to lose whatever water may pass between them, as this loss will be generally found to be much less than the power absorbed by packing. The shaft being put in rapid motion by any first mover, the disc will deliver water into the case *a*, and cause it to flow up the rising main, the pressure of which column of water reacting on the under side of the disc, will tend to lift it upwards; and if the area of the inlet aperture in the cover *i* bear such proportion to the transverse area of the shaft as the specific gravity of iron and water do to each other, then its upward pressure against the disc will sustain the weight of the driving shaft, and prevent any pressure on the end of the shaft. And further, if the area of the inlet be made a little larger, it will give the shaft a tendency to press upwards, and its upper end may be acted on by a screw so as to regulate the width of the joint to the greatest nicety, which will render the use of sunk journals unnecessary at those parts of the shaft which are held in the plummer blocks formed on the rising main.

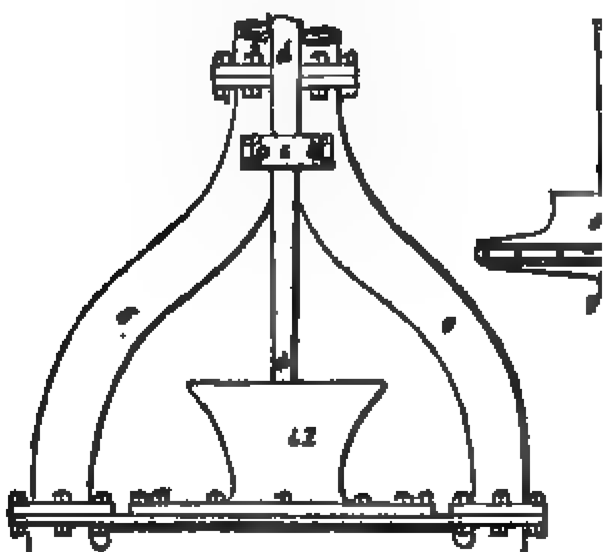
From what has been said, it will be evident that in this form of the apparatus there will be no rubbing surfaces whatever below the surface of the water, no valve of any kind, and no friction but that of the shaft and the metal disc, the former of which is in a manner self-supported, and the latter so smooth as to revolve with very slight resistance through the water. This form of the apparatus has also the advantage due to the rotary motion naturally generated in water passing into a funnel-shaped aperture, by which its after revolution in the disc is facilitated.

When it is required to raise water from a very deep well or mine, it may not always be convenient to apply so rapid a motion to the disc as to exert sufficient centrifugal force to elevate the water to the desired point by a single lift. In that case, however, any number of separate lifts may be made, each delivering the water into a cistern, from which the next lift may take its supply.

*The Disc Lifting and Forcing Pump.*

Fig. 8 is an elevation of this double-acting apparatus.
Fig. 9, a view of the centrifugal wheel.
Fig. 10, a vertical section on the line AB.

Fig. 8. Fig. 9. Fig. 10.



A is an iron casing, as before, divided horizontally into two compartments, bolted together at $A^4$. On the top of the upper compartment, the curved arms B form a support for a main central vertical shaft C, which carries upon its upper end a

capstan head D, for the purpose of allowing the force of a great number of men to act upon it with handspikes. While the men move in a circle around the apparatus, the slow motion of the main shaft, if applied direct to the disc, would produce but little centrifugal force in the water; and the height to which it would rise would, therefore, be very small. But on the shaft C there is fixed a spur-wheel E, which gives motion to a pinion F and shaft G, which works in bearings H at its lower end, and in bearings I at its upper one. The shaft G also carries a cog wheel J, which works in a pinion K on the shaft L, which shaft passes through a hydraulic leather packing M, so as to prevent the water under pressure in the lower compartment of the case from ascending into the upper one, which contains the wheels. The shaft L is supported in a step N, formed in the lower part of the casing, while its upper end works in a gun-metal bearing or bracket P, which is bolted to the central division of the case. The bracket P serves also to support and form a bearing for the lower end of the shaft C. The top cover of the casing $A^1$ has ribs $A^2$ cast upon it, to give it additional strength, and in the centre there is an oil-cup Q, from which oil will find its way through the boss of the wheel and to both the ends of the shafts, &c. To further this object, the shaft C has a hollow cut into it at the part where it passes through the wheel, and the bearings in the bracket have a small hole R leading from one to the other. In the lower compartment of the case there is a conical projection S in the bottom of which there are openings T and valves U to cover them, and immediately below these openings the suction pipe V is screwed on. The upper part of the cone S is turned true, and is made to approach as near as may be, without contact, to the centrifugal disc W, which is made of large diameter and small width, in order to render it suitable for forcing to a much greater height a smaller quantity of water than could be lifted by the centrifugal disc pump constructed as before described. The disc W consists of an upper and lower plate connected together by sixteen radial partitions X, which are wedge-shaped, the height of the openings diminishing gradually towards the periphery. In the lower compartment of the casing there is an opening, Y, to which a pipe may be attached, in order to convey the water raised to any elevated reservoir.

The action of the apparatus is as follows:—Before starting the pump it will be necessary to fill the suction pipe and lower part of the case. A moderately quick motion then being given to the shaft C, the disc will revolve rapidly; the water contained between the partitions X will acquire a considerable amount of centrifugal force, and will flow rapidly into the case, and thence through the opening Y, and up any pipe attached thereto, while the tendency to form a vacuum in the centre of the disc, will cause the ascent of fresh portions up the pipe, and render the operation continuous so long as the motion of the machine is kept up. A forcing as well as a lifting action is thus given to the apparatus, the height in all cases being limited only by the speed of the disc.

The method of applying manual power by the capstan will be found advantageous when a centrifugal disc forcing pump is used, for the extinguishing of fires; such alterations in the general form of the apparatus being made as to render it sufficiently portable and convenient for the purpose; or a cross beam may be substituted for the capstan head, and the power of horses employed instead of that of men.

## SIR FRANCIS C. KNOWLES'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF IRON AND STEEL.

(Patent dated July 4, 1849. Patentee—Sir Francis Charles Knowles, Bart. Specification enrolled January 4, 1850.

*Specification.**

The nature or object of my invention is fourfold, viz.:—

*First*. The making of malleable iron from iro n ores by a direct process, without any previous smelting of the same.

*Second*. The making of steel directly from iron ore.

*Third*. The preparing of iron ores, by cementation thereof, in retorts or kilns separate

* A paper, explanatory of this specification, by Sir F. C. Knowles, will be given in our next.

from the blast furnace, in order to the making of cast iron from the same by smelting them thereafter in furnaces, as usual. And,

*Fourth.* The substitution of certain iron ores afterwards described, to be used as a flux to other ores in the making of cast iron, and as a substitute for the limestone flux at present employed therein.

And the manner in which I carry my said invention into effect is as follows:—For the first two of the above objects or purposes, I select such iron ores as are the most free from earthy matter in their composition, and as approach most nearly to pure oxides of iron—the more nearly the better. For the third object or purpose, I use all iron ores indifferently, excepting only such as contain much sulphur or arsenic; that is to say, all such iron ores as are at present used in the making of cast iron. The ores must be first broken into pieces of moderate size, so as that when placed together in a heap there may be interstices between them, capable of admitting the passage of a gas or vapour through the heap or mass without any great obstruction thereto. Further, if the ores contain any volatile or gaseous matter other than oxygen in their composition, or if they contain water in combination as hydrates, theymust be roasted by some one or more of the methods now in use, in order to expel the same. I then treat as follows the ores which have been so prepared:—I place them in retorts rendered as air-tight and gas-tight as may be, and I raise the said retorts to about a red heat or more, by means of fuel burning around them in furnaces or kilns, into which the said retorts are properly set for the purpose. Each of the said retorts (of which I employ a series, according to the quantity of the ores to be cemented, as hereinafter described) is to be connected with gas pipes, furnished with stopcocks, in such a manner as that a current of either of the gases or the vapour to be hereinafter mentioned may be passed through the said retorts and their contents, or cut off at will, as occasion may require. The form of the said retorts may be cylindrical, as represented in the engraving. Fig. 1 is a front elevation of a set of retorts; fig. 2 is a horizontal section, taken on the line *a b* of fig. 1, in which the arrows denote the direction of the current of gas or vapour, and S *s* are the stopcocks at the entrance of the gas or vapour into the retorts and its exit therefrom respectively.* Each retort is to be provided with a small gas jet in its interior, for the purpose of preventing any explosion before the retort is cleared of the atmospheric air contained in it after it is charged with the iron ores and closed; and such explosion is prevented by lighting the jet of gas, and allowing it to burn for a short time after the retort is so charged and closed, whereby the oxygen necessary to such explosion is consumed. This done, the jet is to be extinguished by the stopcock S, outside the retort. During these preparations the fire must be kept down by a damper. Connected with the gas pipes of entrance and exit S P *s p*, as aforesaid, there are to be gas mains, M M and *m m*, communicating with gasometers such as are now in use in ordinary gas works; that is to say, a main M M, with the gasometer or gasometers which supply the gas before it passes through the retorts and is submitted to the action of the heated iron-ores, and the main *m m*, which receives the gas in its altered state after such passage and such action. I do not claim any particular form or construction of apparatus for the purpose of cementing the ores of iron by submitting the same to the action of the gases or vapour, as hereafter more particularly described; but I merely give the above as what appears to be a good and convenient form of construction for the purpose. The retorts also may be made of cast iron, or even of fire-clay if they be made so as not to be liable to crack, and if the gas or other fittings be carefully adapted thereto, so that the whole may be thoroughly air-tight and gas-tight. Care must also be taken to apply the heat to the retorts as uniformly around them as possible, so as not to produce unequal expansion, whereby they would become liable to crack. It will accelerate the process of cementation if the gas, after leaving the gasometer (or the vapour) be passed through an ordinary hot-blast apparatus, so that it may enter the retorts in a heated state. For the purpose of cementing the iron ores by the above, or some similar and convenient apparatus, I make use of two sorts of gas, namely, coal gas such as is now used for lighting streets and houses, the same being first purified, by the known methods in use, from sulphur or other impurity, and carbonic oxide gas prepared by slow combustion from charcoal, coke, anthracite, or stone coal, peat, or other carbonaceous matter, or otherwise. I do not, however, confine myself to these two sorts of gas alone; for the vapour of coal oil or naphtha, of petroleum, of camphine, or of any other hydrocarbon sufficiently abundant and cheap, may be also employed for cementing the iron ores; neither do I confine myself to the use of gas such as is prepared from coal only, but I claim also the use of gas resembling coal gas in its general composition, the same being made from peat, wood, or other material, the said gas

* The construction of these retorts is so obvious from the verbal description given of them, that we do not think it necessary to engrave the illustrative figures.—Ed. M. M.

being such as to consist mainly of carburetted hydrogen, or of olefiant gas, or of both combined in various proportions together, and occasionally with carbonic oxide, hydrogen, &c., as is well known to persons making gas for public use. I do not claim any particular mode of generating the said gas or gases, or the vapour to be hereafter and above named; but I claim the use of them for the purpose of cementing the ores of iron. I use the coal gas, or gas resembling coal gas, and the said vapour indifferently, whether I propose to make malleable iron, steel, or cast iron from the cemented ores; but I make use of carbonic oxide gas only in order to make malleable iron, or where it is not intended that the ores should absorb any carbon during their cementation in the retorts. When I use the vapour of naphtha or coal oil, of petroleum, of camphine, or other hydrocarbon, I submit the fluid hydrocarbon to heat in proper vessels, as in the ordinary distillation of the same, and I pass the said vapour when so obtained through the heated iron ores in the retorts, as I do the gas, but with this difference, that I conduct the vapour, at its exit from the retorts, into a worm with a refrigerator, whereby it is again condensed for use. Also, in order to carry off any gas which may be evolved from the said vapour by the action of the heated iron ores thereon, I employ a main pipe connected with the condenser and leading to a gasometer, as in the use of the gases. After the gas has passed from the retorts into the main *m m*, which I call the exit main, it is to be purified again by any of the ordinary methods, so as to become free from useless ingredients, and fit for further use. It will be convenient to have several series of retorts and mains, to be used successively in employing the gas over again. As the fresh gas contains most carbon, the first of the series should be employed where steel, or cast iron, or malleable iron is sought to be produced, and the second where malleable iron is the proposed product, and less carbon is required. In all cases it will be desirable to employ at the exit main a trial jet, by means of which the composition of the gas may be examined at pleasure. There should also be a receptacle connected with the retort itself, such as to admit of its being cut off from the body or current of gas in the retort, and of its withdrawing a portion of ore for examination, or a trial retort, by the aid of which, charged at the same time with the ordinary retorts, the progress of the cementation of the ores may be carefully watched by the workman, and the same arrested at the proper point.

The process will now be as follows:—The retorts must be charged with the prepared iron ore, closed carefully, and, if need be, luted with fire-clay and freed from atmospheric air by the gas jet before described; the gas, previously heated or not, is then to be passed in a gentle current through the heated retorts by appropriate pressure on the gasometer or otherwise.

It will then act upon the iron ore as follows:—The ore being mainly an oxide of iron, the hydrogen of the gas or hydrocarbon, if such be employed, unites with the oxygen of the ore to form water, while the carbon unites with the oxygen to form carbonic oxides or carbonic acid, as the case may be, thus leaving metallic iron as the results. It is best to carry this process of cementation a little further (except where carbonic oxide gas is used) so as to allow of a small absorption of carbon by the reduced metal; this carbon is readily burned away in the puddling furnace next afterwards to be used. The iron ore being so far reduced, and whether absorption of carbon has or has not taken place, the next stage of the process when malleable iron is the proposed product, is to shut off the gas on both sides of the retorts, then to open the retorts and to transfer their contents; that is to say, the reduced iron ore to the ordinary puddling furnace, and to treat the iron as in the common way of puddling iron until it "comes to nature," as it is technically termed, and balls, or coheres, or agglutinates together into a mass, when it is to be put under the shingling hammer and rolled out according to the ordinary methods of manufacture. It may be further cut, piled, reheated, and rolled, as usual, according to the nature of its destination, or the quality required. If steel be the product required, the cementation in the retorts must be carried further, until the reduced metal shall have absorbed about 1 per cent. of carbon, after which the gas is to be shut off, the retorts to be opened, and their contents removed as before. The progress of the absorption of carbon must be examined from time to time, just as is at present done in the cementation of iron bars for conversion of the same into steel, until the requisite degree of cementation is obtained. The reduced and cemented ore is then to be put into crucibles or melting pots, and to be run down into ingots in wind furnaces, as is now done in the making of cast steel. If the earthy matter in the ore be such as to require it, some proper flux for the same is to be added, according to the known methods of fluxing iron ores. If cast iron be the product required, the cementation must be carried on until the metal shall have absorbed about 3 to 4 per cent. of carbon, after which it is to be transferred to the cupola or blast furnace, with a proper flux, if need be, to be run down, as is usual in making cast iron. I further claim, where cast iron or steel is

the product required, the separate cementation of iron ores with charcoal, coke dust, anthracite coal, coke, &c., in close retorts, or kilns heated as above; but I do not claim the use of charcoal in retorts for the production of malleable iron directly from the ores. After such last-mentioned cementation by means of charcoal, the cemented ores are to be transferred to the cupola or blast furnace, or to the melting-pot, as before, according as cast iron or steel is the product to be obtained. I claim moreover the treatment in manner following of certain ores of iron, in order to the production of steel; namely, the pure specular ores of iron, the red hematite or oxide of iron, the brown hematite or hydrated oxide of iron, the black oxide of iron, the red and brown ochreous iron ores (when the same are not combined with much earthy matter), the magnetic iron ores, and the ores called spathose (or spathic), iron ores, sparry iron ores, or sometimes white iron ores (from their colour being accidentally white), the said spathose ores being carbonates of the protoxide of iron, and being other than and different from the argillaceous iron ores of the coal measures or carboniferous series of rocks above the mountain lime stone. The term, "spathose ores," is a received and general description of the minerals in question, and is applicable and applied to them even when from partial decomposition they pass into the peroxide of iron, or are combined with it in greater or less proportions. I first prepare any of the ores last before mentioned by roasting them, if necessary, to expel volatile matters, and by previous cementation to about 1 per cent. on the weight of the metallic iron in the ore by some one or other of the methods before described, and I then smelt them in a blast furnace, or cupola, or other suitable furnace, with wood or peat charcoal, or any fuel free from sulphur, using a proper flux, if necessary, of a nature suited to the earthy matters contained in the ore to be smelted, according to the method at present in use. The furnace or cupola, if such be employed, must not exceed 20 to 25 feet in height, and must be constructed so as to be very steep in the boshes, in order that the charges of ore, flux, and fuel may pass rapidly through it, and that the metal in coming down may absorb as little more carbon as possible, and the lowest temperature is to be used which is sufficient completely to bring down the metal. The metal so obtained, I call "steel metal." For coarse purposes, this metal may be worked up directly without further preparation, as an inferior steel, by tilting or hammering, and rolling it as usual. For finer purposes, and where superior quality is required, I take this "steel metal" and I melt it again, more than once if need be, in crucibles or melting-pots, as in the common way of making cast steel, by means of wind furnaces, for the purpose of rendering the ingot when cast as homogeneous as possible.

It may be desirable to obtain such ingot with varying proportions of carbon in it, according to the purposes for which the steel may be destined, and these proportions will be obtained by varying the degree of previous cementation of the iron ore accordingly. It may further be necessary to correct any excess or any deficiency of carbon in the "steel metal." The excess may be corrected by the addition of a small quantity of very pure oxide of iron, or of the oxidized scales thrown off the bars of steel by the hammers or rolls; and the deficiency may be corrected by the addition of a small quantity of charcoal—in each case, to the crucible or melting pot, before putting it into the wind furnace. For very superior and highly homogeneous steel, it may be necessary to remelt the "steel metal" more than once. The average proportion of carbon to be aimed at is about 1 per cent. of the whole weight. Both in the previous cementation of the iron ores, whether for making malleable iron, steel, or cast iron, and in adjusting the proportion of carbon in the "steel metal," and in the ingots of steel much must be left to the care and the skill of the workman, and just as in the present cementation of iron bars for the conversion thereof into steel, the progress of the operation must be carefully watched throughout. Where malleable iron is the product to be obtained, the progress of the operation may be conveniently tested by cutting the ores with a file or a knife, and by trying the filings with a magnet. When the final ingot of steel is obtained, it may be hammered out or tilted, cut, piled, re-heated, and rolled out to the proper size, according to the methods well known and used in manufacturing steel. In respect to this last branch of my invention, I do not claim the simple reduction of the said ores of iron by smelting them with wood, or peat charcoal, or other fuel, into what is called "natural steel," but what I do claim is the combination of the above process of previous cementation with such smelting; and these (or the last mentioned simple reduction) with the re-melting of the said "steel metal" in crucibles or pots, in order to rendering the same perfectly homogeneous and of superior quality. I use also by means of series or sets of retorts, such as I have above described, the gases which are at present evolved from blast furnaces, and are consumed and burned at the heads thereof; I collect these gases by means of pipes or other convenient apparatus attached to the furnace in the higher parts thereof, closing up the head of the furnace entirely if necessary, and in such case chargingit through a sliding door, or revolving hopper,

**in the side of the tunnel head, made as gas-tight as may be. I then purify the said gases by passing them through water and an ordinary purifier, like those now used in gas-works, and I conduct them into gasometers communicating with the mains connected with the retorts, and I then employ them in preparing iron ores, just as I do the other gases before mentioned and described; or I pass the said gases at once, and without purification or collection in gasometers, through the retorts directly, in their heated state. I do not claim any particular form of apparatus for collecting the said gases, nor do I claim the employment of them for other purposes than the cementation of iron ores, as before described. The said last-mentioned gases consist of a mixture of nitrogen, oxide of carbon, hydrogen, carburetted hydrogen, and other gases or vapours; but I claim the use of them in their actual state of combination or mixture, and just as they may happen to be generated, and after purifying them as above mentioned, or without such purification, and directly from the furnace, as above described.**

***Lastly.*** **I claim the use of the above described spathose iron ores, and the ores called "soft mine," derived from them by partial decomposition, and found in the same veins therewith, as a flux to supersede the use of limestone, which is at present used as the flux in blast-furnaces in the making of cast iron; and I use the said spathose ores, as follows:—First, I roast them to drive away the carbonic acid and the water which are contained in them, and then I mix them either first cemented as above, or not, with some of the other ores of iron in such a proportion by weight that the lime contained in the aggregate of the ores and of the fuel may bear the same proportion to the other earth's silica and alumina in the same aggregate as the lime derived in the whole from the limestone now used, from the other ores, and from the fuel, is made to bear to the said earth's silica and alumina in the last-mentioned aggregate of limestone, ores, and fuel. This proportion, according to the known rules, being thus: alumina as 1, lime as 2, silica as 3, and the spathose iron ore, often containing a considerable proportion of lime as its earthy matter, and often oxide of manganese, I substitute it as a flux for the limestone now used. Where richly carburetted cast iron is sought to be produced the furnace should be made flatter in the boshes, so that the charges may descend slowly, and that the ores, especially if not cemented previously, may have time to absorb the required proportion of carbon.**

## THE EXHIBITION OF THE WORKS OF INDUSTRY OF ALL NATIONS.

**The *Gazette* of the 4th instant contains a Royal Commission for carrying this much talked of project into effect. We have waited till it should assume some such official and tangible form as this, before we said anything about it; and we now lose no time in expressing freely the opinion we have formed of it.**

**The Commission is in these terms:**

Victoria, R.

**Victoria**, by the grace of God, of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith; to our most dearly-beloved Consort, his Royal Highness Francis Albert Augustus Charles Emanuel, Duke of Saxony, Prince of Saxe-Coburg and Gotha, Knight of our Most Noble Order of the Garter, and Field-Marshal in our army—our right trusty and right entirely-beloved cousin and Councillor, Walter Francis Duke of Buccleuch and Queensberry, Knight of our Most Noble Order of the Garter—our right trusty and right well-beloved cousin William Earl of Rosse, Knight of our Most Illustrious Order of St. Patrick—our right trusty and right well-beloved cousins and Councillors Granville George Earl Granville, and Francis Earl of Ellesmere—our right trusty and well-beloved Councillor Edward Geoffrey Lord Stanley—our right trusty and well-beloved Councillors John Russell (commonly called Lord John Russell), Sir Robert Peel, Bart., Henry Labouchere, and William Ewart Gladstone—our trusty and well-beloved Sir Archibald Galloway, Knight Commander of our Most Hon. Order of the Bath, and Major-General in our army in the East Indies, Chairman of the Court of Directors of the East India Company, or the Chairman of the Court of Directors of the East India Company for the time being—Sir Richard Westmacott, Knight—Sir Charles Lyell Knight, President of the Geological Society of London, or the President of the Geological Society of London for the time being—Thomas Baring, Esq., Charles Barry, Esq., Thomas Bazley, Esq., Richard Cobden, Esq., William Cubitt, Esq., President of the Institution of Civil Engineers, or the President of the Institution of Civil Engineers for the time being—Charles Lock Eastlake, Esq., Thomas Field Gibson, Esq., John Gott, Esq., Samuel Jones Loyd, Esq., Philip Pusey, Esq., and William Thompson, Esq., greeting:

Whereas the Society for the Promotion of Arts, Manufactures, and Commerce, incorporated by our Royal Charter of which our most dearly-beloved Consort, the Prince Albert, is President, have of late years instituted annual exhibitions of the works of British Art and industry, and have proposed to establish an enlarged exhibition of the works of industry of all nations, to be holden in London in the year 1851, at which prizes and medals, to the value of at least 20,000*l.* sterling shall be awarded to the exhibitors of the most meritorious works then brought forward; and have invested in the names of our right trusty and entirely-beloved cousin Spencer Joshua Alwyne Marquis of Northampton, our right trusty and right well-beloved cousin and Councillor George William Frederick Earle of Clarendon, Knight of our Most Noble Order of the Garter, our trusty and well-beloved Sir John Peter Boileau, Bart., and James Courthope Peache, Esq., the sum of 20,000*l.*, to

be awarded in prizes and medals as aforesaid; and have appointed our trusty and well beloved Arthur Kett Barclay, Esq., William Cotton, Esq., Sir John William Lubbock, Bart., Samuel Morton Peto, Esq., and Baron Lionel de Rothschild, to be the treasurers for all receipts arising from donations, subscriptions, or any other source, on behalf of, or towards the said exhibition; our trusty and well-beloved Peter le Neve Foster, Joseph Payne, and Thomas Winkworth, Esq., to be the treasurers for payment of all executive expenses; and our trusty and well-beloved Henry Cole, Charles Wentworth Dilke, jun., George Drew, Francis Fuller, and Robert Stephenson, Esquires, with our trusty and well-beloved Matthew Digby Wyatt, Esq., as their Secretary, to be an executive committee for carrying the said exhibition into effect, under the directions of our most dearly-beloved Consort:

And whereas the said Society for the Promotion of Arts, Manufactures, and Commerce have represented unto us, that in carrying out the objects proposed by the said exhibition many questions may arise regarding the introduction of productions into our kingdom from our colonies and from foreign countries: also regarding the site for the said exhibition, and the best mode of conducting the said exhibition; likewise regarding the determination of the nature of the prizes, and the means of securing the most impartial distribution of them; and have also besought us that we would be graciously pleased to give our sanction to this undertaking, in order that it may have the confidence, not only of all classes of our subjects, but of the subjects of foreign countries:

Now know ye, that we, considering the premises, and earnestly desiring to promote the proposed exhibition, which is calculated to be of great benefit to arts, agriculture, manufactures, and commerce, and reposing great trust and confidence in your fidelity, discretion, and integrity, have authorized and appointed, and by these presents do authorize and appoint, you our most dearly-beloved Consort, Francis Albert, Augustus Charles Emanuel Duke of Saxony, Prince of Saxe-Coburg and Gotha, you Walter Francis Duke of Buccleuch and Queensberry, William Earl of Rosse, Granville George Earl Granville, Francis Earl of Ellesmere, Edward Geoffery Lord Stanley, John Russell (commonly called Lord John Russell), Sir Robert Peel, Henry Labouchere, William Ewart Gladstone, Sir Archibald Galloway, or the Chairman of the Court of Directors of the East India Company for the time being, Sir Richard Westmacott, Sir Charles Lyell, or the President of the Geological Society for the time being, Thomas Baring, Charles Barry, Thomas Bazley, Richard Cobden, William Cubitt, or the President of the Institution of Civil Engineers for the time being, Charles Lock Eastlake, Thomas Field Gibson, John Gott, Samuel Jones Loyd, Philip Pusey, and William Thompson, to make full and diligent inquiry into the best mode by which the productions of our colonies and of foreign countries may be introduced into our kingdom; as respects the most suitable site for the said exhibition; the general conduct of the said exhibition; and also into the best mode of determining the nature of the prizes, and of securing the most impartial distribution of them.

And to the end that our Royal will and pleasure in the said inquiry may be duly prosecuted, and with expedition, we further, by these presents, will and command, and do hereby give full power and authority to you, or any three or more of you, to nominate and appoint such several persons of ability as you may think fit to be local commissioners, in such parts of our kingdom, and in foreign parts, as you may think fit, to aid you in the premises; which said local commissioners, or any of them, shall and may be removed by you, or any three or more of you, from time to time, at your will and pleasure, full power and authority being hereby given to you, or any three or more of you, to appoint others in their places respectively.

And furthermore, we do by these presents give and grant to you, or any three or more of you, full power and authority to call before you, or any three or more of you, all such persons as you shall judge necessary by whom you may be the better informed of the truth of the premises, and to inquire of the premises, and every part thereof, by all lawful ways and means whatsoever.

And our further will and pleasure is, that for the purpose of aiding you in the execution of these premises, we hereby appoint our trusty and well-beloved John Scott Russell and Stafford Henry Northcote, Esquires, to be joint secretaries to this our commission.

And for carrying into effect what you shall direct to be done in respect of the said exhibition, we hereby appoint the said Henry Cole, Charles Wentworth Dilke, jun., George Drew, Francis Fuller, and Robert Stephenson, to be the executive committee in the premises, and the said Matthew Digby Wyatt to be secretary of the said executive committee.

And our further will and pleasure is that you, or any three or more of you, when and so often as need or occasion shall require, so long as this our commission shall continue in force, do report to us, in writing, under your hands and seals respectively, all and every of the several proceedings of yourselves had by virtue of these presents, together with such other matters, if any, as may be deserving of our Royal consideration touching or concerning the premises.

And lastly, we do by these presents ordain that this our commission shall continue in full force and virtue, and that you, our said commissioners, or any three or more of you, shall and may from time to time, and at any place or places, proceed in the execution thereof, and of every matter and thing therein contained, although the same be not continued from time to time by adjournment.

Given at our Court at St James's, the 3rd. day of January, 1850, in the 13th year of our reign.

By Her Majesty's command,
G. GREY.

**The *probable utility* of this exhibition is, of course, the grand point to be considered, and it is to that view of it alone that we propose to address ourselves; but, at the same time, we may be excused for noticing in passing one or two things about this Commission, which should our investigation lead us to conclusions adverse to the affair, may help to throw some light on the motives and purposes of its promoters.**

**One would naturally expect that a State paper, intended like this to inaugurate a grand public proceeding, having for its object to benefit not this nation alone, but all the nations of the world, and to make England renowned and respected beyond all other lands for her magnanimity and liberality—be the wisdom and policy of the act what it may—should at least breathe nothing but the simple TRUTH. But what do we see? A recital of considerations in which there is hardly a word of truth from beginning to the end, and in which the Royal**

sanction (sad to say) is given to some most abominable fibs.

*It is not true*, that "THE SOCIETY *for the Promotion of Arts, Manufactures, and Commerce* have invested the sum of 20,000*l.* to be awarded in prizes and medals." The Society never had any such sum to invest; and if they had, they have no power under their Charter so to invest it.

What has been done is simply this:—A company of jobbing contractors have, through the instrumentality of the Society, or rather of a clique of small people belonging to it, furnished the 20,000*l.* on the faith of having it repaid to them with interest, and a bonus to boot, out of the proceeds of the Exhibition. Why, then, was not this—which is the real truth—frankly acknowledged? If it was not considered inconsistent with the dignity of the country to raise the ways and means in this way, why should the Sovereign have been advised to shrink from avowing it to the world?

*Neither is it true*, that the SOCIETY have appointed the different sets of treasurers, named in the Commission, or the five persons named to be an "Executive Committee for carrying the said Exhibition into effect under the directions of our most dearly-beloved Consort." We are not ourselves members of the Society, but we are assured by many trustworthy persons who are, that the votes of THE SOCIETY at large were never taken upon any one of these appointments.

*Equally untrue* is it, that the said SOCIETY ever made those representations to the Crown which are set forth in the Commission respecting the "questions which might arise." Persons falsely pretending to represent the Society may have done so; but never the SOCIETY itself.

The persons named as Commissioners afford, in the opinion of the *Times*, which is a warm advocate of the Exhibition (with what consistency we shall see hereafter), a proof that the Government is determined to act with perfect impartiality in the matter. "Every shade of political opinion in the country, every great interest in the State, is adequately represented by its recognised leader, or by an appropriate representative." Yes, even so; but who does not see at once that the circumstance of its including some one of every party and interest in the State, is just the very thing of all others most likely to render it an utter nullity? All history—all the history of this country, at least—proves that nothing good ever came of such coalition broad-bottomed administrations. Better a thousand times a Commission all of one party or interest; working all with one heart and mind, and all partaking (to the entire exclusion of foes and rivals) of the fruits of whatever success may attend their united endeavours.

Besides, what is the real power given to the Commissioners? None at all. They are authorised to INQUIRE and to REPORT a great deal—as much, indeed, as they please; but to *direct*, and *order*, and *execute*—NOTHING. No; there is an "Executive Committee" appointed for everything in the "Executive way;" and what may be comprehended under the term "Executive" is not specified—so that it rests but with the Committee to decide for themselves (!) what may and what may not come within the scope of their particular Commission.

The Commissioners have, indeed, power given them to appoint, and remove certain officers; but who are they? "*Local*" officers only. A very noticeable limitation this. Not a single metropolitan functionary—however he may chance to behave—have they the power either to appoint or remove. Not the power even of appointing their own Secretaries: the Crown has kindly done that for them, and saddled them with secretaries, of whom they may as well try to get rid as the wild horse did of its rider: "We hereby appoint our trusty and well-beloved John Scott Russell and Stafford Henry Northcote, Esquires, to be joint secretaries to this Commission."

Three sets of Treasurers there are, too; but each composed of persons distinct from the Commissioners, and entitled to act entirely independent of them.

If we were at liberty to look upon the

whole project as a rank job—which we are not just yet, and may, possibly, never be—we should say that any arrangement better calculated to make a job of it—to serve private and mercenary ends—could not possibly be conceived, than a body of Commissioners without union or power, and associated with independent secretaries, and treasurers, and executives, responsible to nobody.

Then, who are the persons composing the "Executive Committee?"—"Henry Cole, Charles Wentworth Dilke, Jun., George Drew, Francis Fuller, and Robert Stephenson."

"*Henry Cole.*" Who this person may be, we have no idea. A cousin, perhaps, of King Cole; and *so* known to our most gracious Queen Victoria.

*Charles Wentworth Dilke, Jun.* Son of the proprietor of the *Athenæum.* Worth having, for the sake of the support of that influential journal; but on what *other account?*

*George Drew.* The solicitor to the jobbing contractors who have furnished the 20,000*l.*

*Francis Fuller.* Perhaps one of "Fuller's Worthies,"—perhaps not; nobody knows.

*Robert Stephenson.* A gentleman of great eminence and undoubted fitness, but who is so occupied with a hundred other executives, that he can give no real service to this.

For the "Executive," therefore, of this grand National concern, we have—four Nobodies, and one Somebody, whose name is used for the sake alone of such false credit as his name may confer, and not for the sake of any deliberative or active part which he can possibly take, or was ever expected to take, in the business.

What can either the English people or foreign nations be expected to think of such an "Executive" representation as this? What thinking Englishman would give his willing consent to be so represented?

We do not overlook the fact, that the Executive Committee are to be "under the direction" of the Prince Consort, and are willing to accept this as a sufficient guarantee that the Committee will not be suffered to do anything either very wrong or very foolish. But something more than those benevolent aspirations, and that high sense of propriety for which His Royal Highness is remarkable, is wanted at the head of such an affair as this. "Direction" implies ability to direct—knowledge of men and affairs, quick perception, sound judgment, and resolute will. Of the Prince's qualifications in those respects the public know next to nothing. His Royal Highness has lived too short a time in the world, and lived too little in it, to make it likely that he possesses any one of them in a very high degree. He is famed for his affability and good-nature; but these are precisely the qualities which are most likely to make a person in his position the dupe of the artful and designing.

The *probable utility* of the Exhibition (which, as we have before stated, is the grand thing to be looked at), is adverted to in the Commission in rather a strange fashion,—not as the leading consideration, but as a reflection by the way, for which the *ipse dixit* of "Victoria by the grace of God" is held to be abundantly sufficient:

"Now know ye that we, considering the premises, and earnestly desiring to promote the proposed Exhibition, WHICH IS CALCULATED to be of great benefit to arts, agriculture, manufactures, and commerce," &c.

Where are the proofs that it is so "calculated?" None are given—none referred to. We have but the Queen's word for the fact; and, with all possible respect for Her Majesty's judgment and authority, we must take the liberty of supposing it to be a possible case that Her Majesty may, on this point be under a great delusion.

We shall be told, no doubt, that the assumed utility of the Exhibition does not rest on the Royal word alone;—that Her Majesty and the Prince Consort took previously all imaginable pains to ascertain the opinions of the public at large on the point;—that Commissioners were sent all over the kingdom to make inquiries of those most competent to give advice upon it;—and that public meetings were held in almost

every place of note, at every one of which resolutions were unanimously passed in favour of the scheme. We know all this well, and care not a fig for it all. Public meetings are not places for the calm and dispassionate discussion of any question whatever, and least of all when the suffrages of the assembled crowds are solicited in the name of Royalty, on behalf of a design professing to have the public good for its object. Such manifestations are to be had in any number for the asking, and are, by all men of sense, valued accordingly.

But the Public Press also has been unanimous in favour of the project. Yes; nearly so, we believe. We have no wish to disparage the authority of the Public Press, but we may be excused for insisting that it shall not pass for more than it is worth. If we show, as we shall presently do, that the leading journal, which now supports the project so warmly, and has apparently given the cue to all the others, did once on a time, and that within the memories of most living men, denounce every scheme of the sort as utterly erroneous in principle and practically useless, we shall then be entitled to ask Public Press to vindicate its consistency before it claims to exercise the slightest influence on the present occasion on public opinion.

The time of which we speak was some twenty-two years ago, when a project very similar to the present, with the exception that there were no prizes, and none but British manufactures exhibited, was set on foot, AND FAILED—a fact most important to be known, but of which we are told not a trace is to be found in any of the reports or statements made to Prince Albert by the promoters of the present movement.

The exhibition to which we allude was the "National Repository" of 1828-29, which had THE KING, (George IV.) for "Patron," and a "Board of Management" composed, exactly like the present Commission, of a number of the most distinguished noblemen and gentlemen of the day. The project, too, had the hearty support of the King's Ministers, who gave the managers the free use, for the purposes of the exhibition, of an extensive and commodious gallery and range of rooms in the King's Mews (since taken down, to give place to the National Gallery). We had the misfortune to stand alone in questioning the utility of that exposition. We gave, as our reasons (*Mech. Mag.*, 19th April, 1828), that "it was at variance with the established tastes and habits of British artizans and manufacturers; that exhibitions of this kind might suit countries where the arts are still comparatively in a state of infancy, and stand in need of every sort of adventitious aid; but were wholly superfluous among a people like the British, who have, without any such exhibitions, eclipsed all other nations in the variety and excellence of their manufactures, and with whom supply and demand have long since worked out other and better channels for themselves." We asked, if it was "seriously expected that the Boltons, the Wedgewoods, the Strutts, the Arkwrights, or the Bramahs of the day would resort to such an exhibition as that in search of patrons and consumers? And if they did not, what pretence such an exhibition could have to the character of a *national* one as compared with the Exhibition of France, the Netherlands, and the American?" We have not the vanity to suppose that our objections exercised any material influence on the public mind; we can but claim for ourselves the merit, such as it may be, of having very distinctly predicated its failure. Fail it did, most miserably; and *then* the TIMES, which had previously looked upon it rather with favour, came out with the following vigorous and truthful exposition of the folly of the whole affair:

"Supposing the Repository were as splendid in its character, and as universal in its range, as our national ingenuity and enterprise could make it, we should still object to its pretensions on other grounds. The utility of such shows, in a country like England, we think, extremely questionable—let the scale on which they are conducted, or the patronage with which they are honoured, be what they may. An exhibition of the products of manufacturing skill and mechanical invention, in one great

show-room, so arranged as to attract the gaze of the public, can only be beneficial in one of two cases; either when industry is so degraded and discouraged as to require a counterbalance in the admiration of the great public of the metropolis for general neglect, or when the means of communication between the different districts of a country are so inadequate as to prevent the rapid spread of improvements, and to confine the knowledge of invention, or the reputation of inventors, for a long time to the place of their primitive display. Is either of these the case with Great Britain? Is the manufacturer so degraded as to require to be raised in his own estimation by seeing crowds of curious idlers, or fashionable loungers, assembled to admire his productions? Does he need the criticism of the public, who must be less skilful than himself, to improve those arts on which his existence, reputation, and fortune depend? Is his competition with his rivals in trade not sufficiently stimulated dy the desertion, or the increase of his customers, unless he likewise sends samples of his handicraft to stand a comparison with theirs in the same gallery? Is any invention or improvement likely to remain long neglected in a country where the rage for novelty is so great, and the means of communication are so cheap and rapid—which has so many stage-coaches and commercial travellers; so many Mechanics' Magazines and Philosophical Journals; so many facilities of advertising in reviews and newspapers? In seeing a manufactured article, the process by which it has attained its perfection cannot be learned by a rival manufacturer; and to appreciate its excellence the taste of the purchaser or consumer does not require to be cultivated or purified, as in the case of the fine arts, by the repeated exhibition of masterpieces. One does not require to be a connoisseur in the treasures of a 'Repository,' patronised by Lords and Members of Parliament, to select a good piece of cutlery, or a straw-bonnet; a pair of waterproof shoes, or even a periwig on the new plan, which is exhibited at the King's Mews.

"But it may be said, that as no manufacturer, artisan, or inventor, is obliged to send his contribution to the Repository, and as no passenger is compelled to come in and examine it, the enterprise is at least harmless and innocent; that it forms another mode of advertising, another bond of connection between the manufacturer, and retail purchaser or consumer; and that if one purchase is made, or one meritorious man encouraged, in consequence of the public display, there is so much gained. Even this negative merit we are disposed to question, without such a drawback as would, perhaps, equal its value. The admiration bestowed on a choice piece of art exhibited in a public collection, may often have the effect of leading the manufacturer to bestow upon specimens entered for the show, a degree of labour beyond their worth. It thus acts like a bounty in directing industry into unprofitable channels. It diverts the competitors for public applause to laborious trifles or useless novelties, to attract an attention which could not be excited by the productions of regular and profitable industry. Thus, some of the exhibitors are admitted and ruined,—wasting their skill and labour on articles which are intended for a public show-room, and not for a public market. In France, where Expositions have been so long in vogue,—even before the restoration of the Bourbons,—where such Exhibitions were made a government affair, and where they occur periodically, accompanied with great splendour, sensible men have begun to see that they are sometimes injurious and always of questionable utility. Professor Blanqui, in giving an account of the last, which took place in the autumn of 1827, mentions, as an instance of their injurious tendency, that a carpet was exhibited which occupied two years in making, and contained 4,000 ostrich feathers! Would it not be absurd to encourage the manufacture of such useless and expensive rarities? Without further discussing topics on which only the high respectability of the Committee of Management would have induced us to dwell so long, we may conclude by remarking, *that the public will always be found the best patron of the useful arts*; the *consumer* the *best judge; the shops of a great city the best 'National Repository;' and a ready sale, with prompt payment, the best premium of encouragement.*"

Every word nearly of this article is just as applicable to the proposed Exhibition of 1851 as to that of 1828, 1829. There are but two grounds, as it seems to us, on which a change in the opinions there expressed can be justified; namely, the two particulars in which the new Exhibition is to differ from the former—*first*, in its being open to all nations; and, *second*, in there being a large sum to be given away in "prizes and medals." We shall investigate the value of these two considerations in our next.

THE ELECTRIC LIGHT.

[The public have experienced so many disappointments respecting this light,—it has been so often represented as attended with "perfect success," without that perfect success ever leading to its practical adoption anywhere,—that people have fairly enough begun to regard with exceeding incredulity any announcement respecting it. We do not hesitate, nevertheless, to present our readers with an account of one exhibition more, which has been communicated to us by a correspondent on whose judgment and impartiality we place great reliance; for it does appear from it, that all the difficulties of the case have at length been really surmounted, and an actual electric lamp produced, which gives a steady, enduring, and most brilliant light, without any perceptible flickering or intermission.—ED. M. M.]

On Monday last there was an exhibition at Crosby Hall of Mr. Staite's electric light, which demonstrated more decisively than has ever yet been done, the capability of its application to domestic and public illuminating purposes. Mr. Staite made use of a regulating magnet on the plan fully described in *Mech. Mag.*, vol. L., p. 48, and most admirably did it perform its functions. In addition to the advantage of being self-acting, this apparatus is so sensitive of the slightest variation in the electric current, and so instantaneous in its controlling action, that no unsteadiness of light is perceptible. Mr. Staite also exhibited a small iridium lamp, in which the illuminating medium was composed, as the name indicates of iridium, and which appeared to be particularly applicable to domestic and other purposes where a very powerful light is not required, but one that will last long without attention, and be of little cost. Another lamp, in which carbon points was employed for producing the light, was subsequently exhibited, and certainly for steadiness and brilliancy it surpassed every other known artificial light—so powerful, indeed, that the eye could not look upon it without being painfully fatigued. To counteract this to some extent, it was inclosed in an enamelled glass globe of about 24 inches diameter—which appeared as an enormous globe of pure and brilliant white light. There can be little doubt that 'ere long we shall see gas and oil-lighting, with all their attendant evils of blacks, heat, &c., replaced, at least in all large public buildings and thoroughfares, by the electric light.

THE PRIZE STEAM ENGINE OF THE NORWICH AGRICULTURAL MEETING.

We have received a note from Mr. Baddeley, in which he states that he is "not able to send a reply to Mr. Garrett" in this week's Number, but will furnish it "in good time for the next." We regret this much; for the matter is not of a sort to brook delay. No person should *volunteer* so serious a charge as one of "fraud" against any one, without being ready to exhibit his proofs instantly on demand; nor is it allowable to any Editor to leave such a charge unretracted for a single hour longer than may be absolutely necessary for an investigation into its truth. Failing any explanation from Mr. Baddeley, we have ourselves made careful inquiry into all the facts of the case, and we are so satisfied of his being in the wrong, that we do not hesitate at once to state our entire conviction that the charge was without any good foundation, and to express our deep regret that it should have been made through the medium of our pages. The charge was, that Messrs. Garrett and Son, of Leiston, the proprietors of one of the oldest and largest agricultural machine establishments in the kingdom, had passed off the portable steam engine which gained the prize at the Norwich Agricultural Show, as of their own manufacture, when, in fact, it was made by Messrs. Easton and Amos, by whose advice the prize was awarded. Now, it has been proved to us, beyond all doubt, not only that the engine in question was designed and put together at the Leiston Works, but that every part of it was manufactured there, with the exception only of the fly-wheel, shaft, and boiler. Messrs. Garrett and Son did only what every one acquainted with mechanical matters must know is the commonest thing in the world among engine-makers,—they made parts of the work themselves, and ordered parts from others. It is the planning and fitting—the general arrangement and adaptation—which make up the sum of the merit displayed in all such cases; nor does there seem the least reason to believe that the judges looked to anything else when they awarded the prize to Messrs. Garrett and Sons.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING 10TH OF JANUARY, 1850.

JAMES MULBERRY, of Parkersburgh, Chester County, State of Pennsylvania, U. S., machinist. *For certain improvements in the slide valves of steam engines.* Patent dated July 4, 1849.

This invention has for its object to render

the slide-valves of steam engines, more especially those of locomotive engines, more perfect in their action, and consists in constructing them in such manner that they shall continue for a longer time than they now do with their rubbing surfaces in that complete and steam-tight state in which they generally are when delivered from the hands of the engine builder. As these valves and the cylinder-valve facings which they rub against are now constructed, they soon become deeply scratched or grooved in a direction parallel to the line of motion of the valve, and in proportion to the inequalities of surface thus produced, the steam passes through the valve without causing any useful effect upon the piston.

It has been commonly supposed that this scratching or grooving is caused by some hard substance introduced into the valve-casing, either along with the steam or with water which finds its way through the steam pipes; but the patentee states that he has ascertained, by frequent and careful observation, that it arises chiefly, if not solely, from metallic particles detached from the valves and valve facings themselves. Hitherto it has been the practice to make the openings from the rubbing surfaces quite sharp, or at right angles with the plane in which the slides move, the consequence of which is, that the edges of these openings soon yield, from want of side support, to the pressure and friction to which they are exposed, and become detached in small portions, which get jammed between the valve and the facing, and thus produce the injurious effects just adverted to, and which it is the purpose of this invention to remedy.

The edges or corners, which have been hitherto made at right angles with the rubbing surfaces, are here rounded or flattened off to such an extent as to be no more liable than other parts of the valve and facing to abrasion.

*Claim.*—Making the corners or edges of the openings in the slide valves of steam engines rounded instead of angular, as described

Pierre Augustin Chauffourier, Regent's Quadrant, merchant. *For improvements in castors.* (A communication.) Patent dated July 4, 1849.

The patentee describes and claims an improved castor, which is constructed in the shape of two hemispheres, having a horizontal segmental piece interposed between them. The two hemispheres are riveted on a vertical axle, which passes through the segmental piece, and turns freely therein. The ends of the segmental piece are made hollow to receive the ends of two screws which pass through the ends of a semicircular bar, and support the ball, allowing it to turn thereon. The top or centre of the semicircular bar is attached to the article of furniture.

Thomas Greenwood, Goodman's-fields, London, sugar refiner, and Frederick Parker, New Gravel-lane, Shadwell, animal charcoal-manufacturer. *For improvements in filtering syrups and other liquors.* Patent dated July 4, 1849.

This invention has for its object to keep the filtered syrup of one uniform character, and consists in employing a series of beds, arranged in a circle, communicating one with the other, and containing one more than is to be used, in order that the syrup or other saccharine solution may flow first into the filter that has been longest in use, second into the one that has been next longest in use, and so on throughout the series, excepting the last one, which is not brought into use until the first is charged with impurities and thrown out of communication with the rest, when it is cleansed and re-charged with filtering materials. The second bed then becomes the first, and the extra one the last of the series; when, in like manner, the second bed is thrown out of the circle, the third takes its place, and what was originally the first of the series becomes the last.

*Claim.*—The mode described of filtering syrups and other liquors containing saccharine matters.

James Robinson, Patterson-street, Stepney, engineer. *For improvements in machinery for moving and raising weights.* Patent dated July 4, 1849.

These improvements consist in certain additions to and modifications of, a peculiar construction of ships' windlasses, which was the subject of a patent granted to the same gentleman some years back, and in which rotary motion was communicated to the barrel by means of a nipping plate and lever connected to a cross head on the top of the paul post, and actuated by a horizontal shaft worked by hand levers attached to the ends thereof. The present invention has for its object to vary the power communicated to the windlass by employing a second lever connected on one side to the nipping lever, and on the other side to the cross head, by adjustable rods which admit of the leverage being varied. The horizontal rod is provided with slots in the ends, in order that the lengths of the hand levers fore and aft the windlass may be regulated as required. The patentee claims several modifications of the preceding arrangement, as described and illustrated by eleven sheets of drawings.

John Grantham, Liverpool, engineer. *For improvements in sheathing ships and vessels.* Patent dated July 4, 1849.

Mr. Grantham proposes to sheath iron vessels with copper or other suitable metal, and to prevent galvanic action by interposing between the vessel's sides and the sheathing another sheathing of wood, or gutta percha, or gutta percha compound. For this purpose, he constructs the vessel with external projecting ribs of a wedge-shape, so as to form dovetailed sides, and in the spaces between the ribs he inserts pieces of wood or some non-conducting material, which are thereby firmly retained in position. To these he attaches a sheathing of wood, or gutta percha, or its compounds, care being taken when metallic fastenings are employed not to allow them to come into contact with the ribs or sides of the vessel. And it is to this external sheathing that the copper or metal sheathing is to be affixed.

When it is required to dry the sides of the vessel, and heat them when adhesive materials are used, the patentee proposes to employ a double cylinder of sheet iron, having a coke furnace in the bottom and a fan at one end, while the opposite end is provided with an escape pipe, through which the heated air and products of combustion may be driven (after the fire has burnt clear), and caused to impinge against the sides of the vessel. The cylinder is provided with wheels to facilitate its removal from place to place.

*Claims.*—1. The application of copper or other metal sheathing to iron ships or vessels, by interposing between it and the sides of the vessel another sheathing of some non-conducting material.

2. The employment of external ribs or projections for the purpose of facilitating the sheathing of ships or vessels.

3. The construction and arrangement of mechanical parts which constitute the moveable hot-blast apparatus to facilitate the sheathing of ships or vessels.

Josiah Bowden, Liskeard, linen-draper, and William Longmaid, Beaumont-square, Middlesex, gentleman. *For certain improvements in the manufacture of soap.* Patent dated July 4, 1849.

The patentees remark, that it has hitherto been the practice to manufacture soft soap from hard soap, and that the object of their invention is to manufacture it direct by the following means:—They first make an alkaline lye of 5° Twaddle's hydrometer, preferring to use "soda ash of a strength of 80§ carbonate of soda;" (what does this mean?) To 20 gallons of lye are added 12 lbs. of tallow, and 8 lbs. of rosin. When the tallow and rosin are dissolved, the mixture is boiled for 20 minutes, after which it may be ladled out in forms, and is ready for use.

No claims.

Henry Bailey, Wolverhampton, Stafford, chemist. *For certain improvements in the construction of articles of wearing apparel, which improvements may be applicable to fastenings for the same.* Patent dated July 4, 1849.

The patentee describes,

1. "A metallic safety pocket," which is composed of woven wires, and fitted with a self-acting clasp to admit the hand to the interior of the pocket.

2. A variety of fastenings which consist in each case of two pieces stamped out of sheet metal, with tongues, or pins and slots.

3. A shirt-collar fastening, which consists of two pieces of elastic webbing attached to the ends of the collar, while their own free ends are fitted with metal clasps, which are brought round and linked together in front of the neck.

4. The application of these kinds of fastenings to trousers, and other articles of dress.

5. A peculiar kind of button.

The claims refer to the improvements as described in the specification and drawings.

John Browne, Great Portland-street, Portland-place, esquire. *For improvements in apparatus to assist combustion in stoves or grates.* Patent dated July 4, 1849.

The patentee proposes to place a hollow truncated reticulated cone inside the fire, against the sides of which the fuel rests, whereby the upward draught is maintained, and the combustion is assisted. In some cases an additional chimney is put on the top of the cone to increase the draught; and when the kettle is put on the fire, in order to prevent it resting on the top of the cone, and thereby obstructing the draught, the cone is fitted with a cover having points projecting upwards, on which the bottom of the kettle rests.

*Claim.*—The application of an apparatus, as described, to stoves or grates, for the purpose of assisting combustion therein.

Robert William Thomson, civil engineer. *For certain improvements in writing and drawing instruments.* Patent dated July 4, 1849.

The world has already witnessed one great revolution in the caligraphic art—the general substitution of steel pens for the goose quill of eighteen centuries' antiquity. An effort was lately made in the interest of the shambles, to supersede steel by bone, but it has met with little or no encouragement. We have now to record the advent of a competitor of much more hopeful pretensions. It is glass now which takes the field against steel, and challenges it to a trial of merit on four distinct grounds; first, that it can with-

stand rust, which steel cannot; second, that it defies acids, which steel does not; third, that it bears the friction of writing better than the best steel ever produced; and fourth, that its strokes, though not so cutting nor so heavy as those of steel, are much finer, much clearer, and of a uniformity altogether unapproachable by either steel or quill.

In its simplest form, this new instrument consists of a plain glass tube, with a capillary bore of about the one thirty-second of an inch, which has been blown at one end into a bulb, having very much the appearance of a parrot's beak. The thick or enlarged part serves as a reservoir or fountain for the ink, and the point or nib as the pen, there being a free communication as well between the fountain and the nib as between the fountain and the capilliary channel. The fountain is filled by inserting the point of the instrument in a quantity of ink, then applying the mouth to the top, and sucking out the air, the place of which is instantly occupied by the ink. When the mouth is withdrawn, the restored pressure of the atmosphere prevents the ink from rising in the tube, so that the instrument may be tossed about or even inverted without any risk of the ink escaping.

Artificial exhausting pieces are sometimes attached to the head of the instrument, to supersede the necessity of using the mouth; or forcing pistons, used after the manner of the ordinary fountain pens; and sometimes also the instrument is made in part only of glass and in part of other materials.

William Henry Wilding, of the New-road, gentleman. *For certain improvements in engines and machinery for obtaining and applying motive power.* Patent dated July 4, 1849.

These improvements embrace—

1. An improved method of converting a reciprocating into a rotary motion.

2 and 3. Two modifications of the preceding.

4. An improved method of obtaining a reciprocating lifting action from a rotary motion.

5. A method of enabling steam engines to make several turns of the main shaft for each stroke of the piston.

6. An improved paddle-wheel, with two modifications.

We shall hereafter give at length the first and second heads of this specification. The methods described are exceedingly ingenious, and likely to be of great utility.

Claims, as above.

Edward Ives Fuller, Margaret-street, Cavendish-square, carriage-builder; and George Tabernacle, Mount-row, Westminster-road, coach iron-founder. *For certain improvements in metallic springs for carriages.* Patent dated July 7, 1849.

*Claims.*—1. A mode of connecting carriage springs by means of a stud or pin upon the end of one spring, which takes into a slot in a box attached to the end of the other spring; also, connecting a spring in like manner to a rigid bar or scroll iron.

2. A method of connecting springs of carriages by causing the end of one of them to rest on or between metal bearings attached to the forked end or frame supported by the other spring.

3. A means of connecting carriage springs by a bell-crank lever or sector-piece, whereby the rigidity or tension of the spring is increased in proportion as the pressure thereon is increased.

Richard Archibald Brooman, of the Patent-office, 166, Fleet-street. *For improvements in steam generators.* (A communication.) Patent dated July 4, 1849.

These improvements are based on the recent discoveries by Boutigny of the peculiar properties exhibited by fluids when projected in small quantities upon highly heated surfaces, and have for their object the practical application of that discovery to the generation of steam for motive purposes. We shall give the details with engravings in a future number.

William Bush, of Great Tower-street, London, civil engineer. *For improvements in lamps and in lighting.* Patent dated July 4, 1849.

*Claims.*—1. The employment, in connection with spirit lamps, oil lamps, candle lamps, gas burners, and other instruments or apparatuses for lighting, of reflectors composed of parabolic plates of glass, silvered or quicked at the back by any process or processes whereby the silvering or quicking is prevented from running at high temperatures.

2. The employment of reflectors made of plates of coloured glass silvered or quicked.

3. The employment, in connection with lamps and other instruments and apparatuses for lighting, of glass reflectors, silvered or quicked at the back, and dipping more or less within the ring of flame, whether that ring is composed of one body of flame or a number of flames arranged in a circle.

4. Several improved forms of lamps which are figured and described.

5. The employment, in lamps and other lighting apparatuses and instruments, of pillars, pedestals, or standards formed of hollow glass, and silvered or quicked at the back.

6. A peculiar form of candle.

7. A floating marine preserver.

8. The partial covering of conical reflectors with silvering or quicking.

9. A deck light.

10. The construction of chandeliers of hollow pieces silvered or quicked.

RICHARD GARRET, Leiston Works, Suffolk, agricultural implement maker. *For improvements in horse-shoes, pug-mills, drilling and thrashing machinery, and in steam engines and boilers for agricultural purposes.* Patent dated July 7, 1849.

The patentee describes and claims,

1. The constructing the cylinder or barrel of pug-mills with grated recesses, in order that when the clay or other plastic material is forced through gratings to separate stones or other extraneous substances from it, these substances may be removed, as occasion may require, without stopping the operation.

2. An improved method of steering horse-hoes or drills in a horizontal instead of a curved line, as hitherto, by employing parallel bars or a parallel frame, to which the coulters are connected by independent suitable arms or levers.

3. A means of varying the inclination of the cutting edges of the coulters.

4. A mode of raising, in drilling machines the roller and its appurtenance off the ground, and, at the same time, throwing the feed roller out of gear.

5. The adaptation to broad-cast drills of a grooved or toothed roller, on to which the manure is supplied from the reservoir, whereby the manure is distributed more evenly and regularly than has hitherto been customary.

6. Placing the bars of the concave in thrashing machines which hold the ears "back."

7. Making the faces of the holding bars tangential to the periphery of the beating roller.

8. The application of a riddle or screen to thrashing machines, for the purpose of separating the short straw, &c., from the finer stuff.

9. A peculiar construction of locomotive thrashing machine, in which the apparatuses for thrashing, winnowing, and riddling are combined.

10. A peculiar arrangement of boiler and flues of portable steam engines for agricultural purposes, in which the heat and products of combustion pass to a chamber in the end of the boiler opposite the furnace, and pass thence through a horizontal tube in the centre of the water, which opens into the bottom of a chimney, up which they escape.

11. A peculiar construction and arrangement of moveable agricultural steam engines upon the same sole plate, in which the only connections between the engine and boiler are the steam and water pipes.

12. The use of inclined planes on a circular disc, up which antifriction rollers on the end of a cross head are forced by the resistance of the air to the movement of a pair of fans. [This apparatus or steam generator consists of the ordinary spindle, which is made to rotate in proportion to the speed of the engine, and carries a disc with inclined surfaces on the top. The spindle carries also a cross head, with antifriction rollers at the ends, and beyond them two fans. The rollers rest on the inclined planes, and are kept at the lowest part thereof by means of a weight sliding over the spindle and resting upon the top of the cross head. The spindle is connected to the throttle-valve, and as the speed of the engine increases the resistance of the air to the pans will force the antifriction rollers up the inclined planes, and thereby cause the cross head and weight to slide up the spindle.

JOHN COMBE, Leeds, York, civil engineer. *For improvements in machinery for heckling, carding, winding, dressing, and weaving flax, cotton, silk, and other fibrous substances.* Patent dated July 4, 1849.

The specification of this invention covers fourteen skins of parchment, is illustrated by reference to eight sheets of drawings, and concludes with no less than thirty-one separate claims.

The most striking novelty described and claimed in relation to "heckling and carding," is a peculiar construction of flax-holder, whereby the strick of flax is held, and *both* ends of it subjected to the heckles at the same time. The improvements in "weaving" are twelve in number, but none of them of any striking importance.

JOHN GOODIER, Mode-wheel Mills, Manchester, miller. *For certain improvements in mills for grinding wheat and other grain.* Patent dated July 9, 1849.

*Claims.*—1. A mode of balancing the running mill-stone so as to allow it to oscillate during the action of grinding.

2. The application, in combination with the preceding mode of balancing the runner, of currents of air to the rubbing surfaces, by means of air tubes or passages, or fans or blowers.

WILLIAM LAURIE, Carlton-place, Glasgow, merchant. *For improvements in means or apparatus to be employed for the preservation of life and property, such improvements or parts thereof being applicable to various articles of furniture, dress, and travelling apparatus.* Patent dated July 9, 1849.

The patentee describes and claims sixteen different contrivances for giving buoyancy to articles of furniture, dress, &c., but none of them at all remarkable for novelty. Waterproof materials and air-tight cellular compartments, which are the two things chiefly relied on, have been long in common use.

### *Specifications Due, but not Enrolled.*

WILLIAM HENRY BROWN, Warn's-end Wheel at Wadsley, Ecclesfield, York, steel-roller. *For an improvement in rolls for rolling flat and half-round file and other iron and steel.* Patent dated July 4, 1849.

ROBERT WEARE, Argyle-street, Birkenhead, clock and watch-maker, and WILLIAM PETER PIGGOTT, Wardrobe-place, Doctors' Commons, mathematical instrument-maker. *For certain improvements in electric batteries, and in the production of light; also a mode of transmitting or communicating intelligence for the better protection of life and property; part of which improvements are applicable to other like purposes.* Patent dated July 4, 1849.

THOMAS SEDGWICK SUMMERS, Cornwall-terrace, Lee, Kent, lighterman. *For certain improvements in fastenings for mouths of sacks and bags.* Patent dated July 9, 1849.

### WEEKLY LIST OF NEW ENGLISH PATENTS.

David Blair White, of Newcastle-upon-Tyne, doctor of medicine, for an improved mode of ballasting and stowing cargo in ships and other vessels. January 8; six months.

### WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Jan. 4 | 2134 | John Wilson | Manchester | Elastic riding belt. |
| ,, | 2135 | Henry Stephenson | Howley-street, Lambeth | Atmospheric churn dasher. |
| 5 | 2136 | Henry Moore Naylor | Birmingham | Hook and eye. |
| 7 | 2137 | Edwin Kesterton | Long-acre | Carriage (the Akolaston). |
| ,, | 2138 | Deane, Dray, and Deane | King William-street | Gas stove. |
| 8 | 2139 | George Church | Clifton, Bristol | Wrist supporter for facilitating the practice of the piano-forte, organ, or seraphine. |
| ,, | 2140 | Richard Townley | Cursitor-street, London | Plat or plait. |
| 9 | 2141 | John Cornes | Carrow Works, Norwich | Dressing machine. |
| ,, | 2142 | Edward Grey Williams | Liverpool | Screen and smut machine. |
| ,, | 2143 | Peter Hunter Irvin | Hope-terrace, Nottingham | Portable wash-hand stand dressing-case. |

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, 166, Fleet-street.


## WILDING'S PATENT IMPROVEMENTS IN OBTAINING AND APPLYING MOTIVE POWER.

Fig. 1.

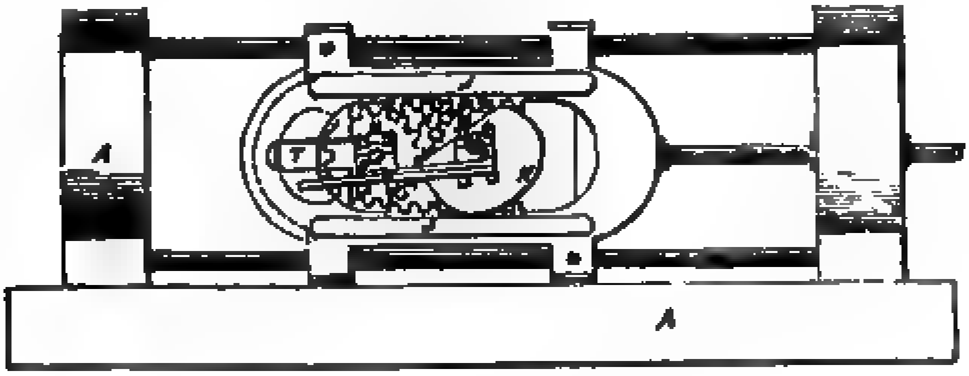


Fig. 5.

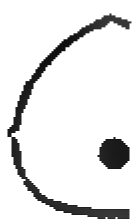


Fig. 4.

Fig. 3.

Fig. 4ª.

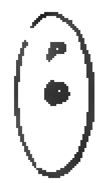
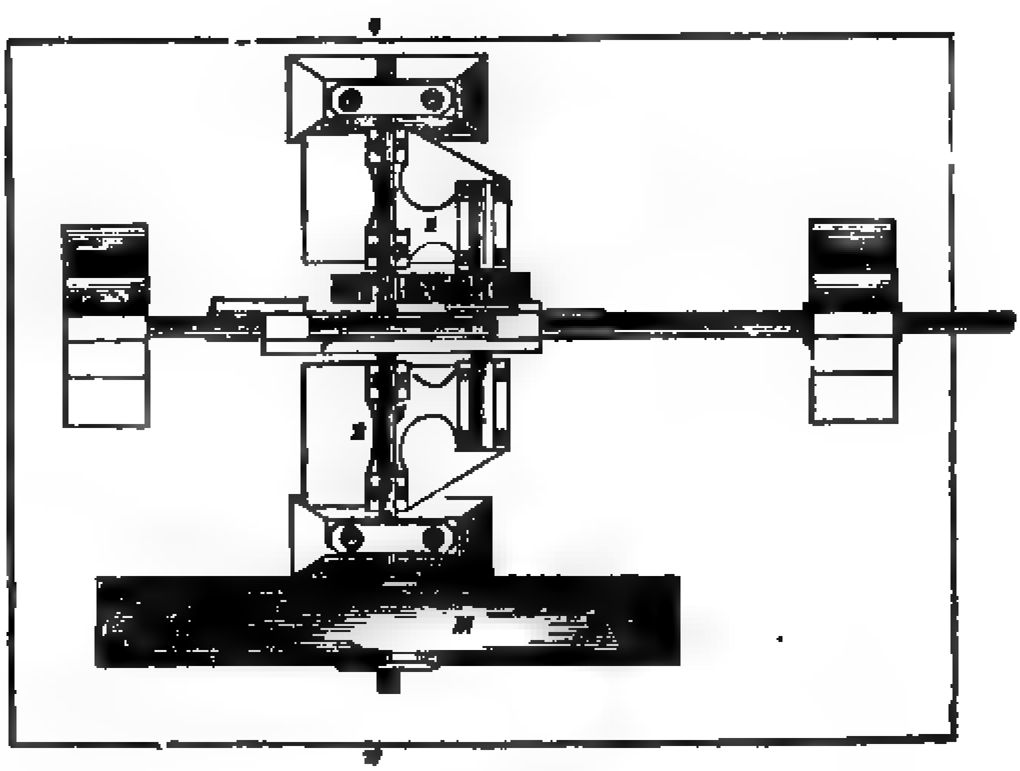


Fig. 2.



## WILDING'S PATENT IMPROVEMENTS IN OBTAINING AND APPLYING MOTIVE POWER.

[Patent dated July 4, 1849. Patentee William Henry Wilding, Gent., New-road. Specification enrolled January 4, 1850.]

The loss of power in reciprocating steam engines, arising from the direction in which the piston works, having to be reversed twice for each turn of the main shaft, has led to many ingenious plans for obtaining a rotary motion direct from the steam; but we believe it may be asserted with truth, that no one has yet succeeded in obtaining the same amount of power from a given quantity of steam through the medium of a direct rotary motion as from the old rectilineal-reciprocating one. Into the reasons of this it is unnecessary here to inquire. Mr. Wilding, instead of abandoning the reciprocating system altogether, has sought to diminish, if not entirely to remedy, the loss of power complained of, by diminishing the frequency of the strokes; that is, by making each stroke of the piston long enough to produce a number of turns of the main shaft. And this he has done in a very ingenious and apparently most effectual manner; though his arrangement for the purpose is attended with this curious peculiarity, that the shaft can only make 3, 5, 7, or some other odd number of revolutions for each stroke of the piston. The point at which the rotary motion is obtained, is always at a right angle to the piston rod, so that the steam is constantly exerting its full power, and may be worked expansively with greater advantage than by any other form of application. The fewer the movements of an engine, moreover, the less must be the tear and wear; and the saving on this account also must be very great. The patentee has now at work an engine on this plan, which works a set of circular saws at an average rate of 120 turns per minute.

### *The Specification.*

*Firstly.* My invention consists in an improved method or combination of mechanical means for converting a reciprocating into a rotary motion. Fig. 1 is an elevation of a model intended to exhibit the details of this combination. Fig. 2 is a top plan of the same, and fig. 3 a transverse section on the line *a b*. A A is the framework. B is a double rack-piece, which is connected at top and bottom by slide-pieces *a a* to guide rails $R^1 R^2$. S is a steam-cylinder piston rod, which is supposed to be connected to the outer end of the rack B, and to be used to impart a reciprocating movement to it. D is a shaft which is mounted transversely to the rack-piece B, and passes through between the two racks. W is a fly-wheel fixed on the end of the shaft D, to which wheel rotation is proposed to be given through the medium of the reciprocating action of the rack-piece B. G is a shaft which carries the pinion H, by which the rack-piece is actuated. This shaft, G, turns in bearings raised on the top of two vibrating plates E E, suspended from the wheel-shaft D, which allows of the shaft G rising and falling according as it is acted upon by a cam K, fixed on the shaft G alongside of the pinion H. J J are two guide pieces for the cam to work in, which are affixed to one side of the rack-piece B, and run parallel to the two racks. The office of this cam, K, is to reverse the line of action of the pinion H, and shift it alternately from the upper rack to the lower, and *vice versâ*. The rotary movement thus given to the shaft G is transmitted through the medium of the pinions M N, one attached to the shaft G, and the other to the shaft D, to the wheel W. T is a recess in one end of the rack piece, for the temporary reception of the wheel-shaft D at each reversal of the rack motion. P is a second cam, which is affixed to the shaft D on the side opposite to K, and at each reversal of the rack motion comes into gradual contact with one or other of the projecting stop pieces V V, and thereby relieves the apparatus from the shock which such reversal would otherwise occasion. The proper form to be given to the cam K is thus found:—Take the distance from the centre of the shaft G when the rack

Fig. 10.

Fig. 8.

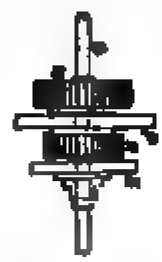


Fig. 9.

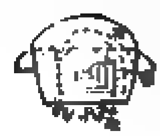


Fig. 6.

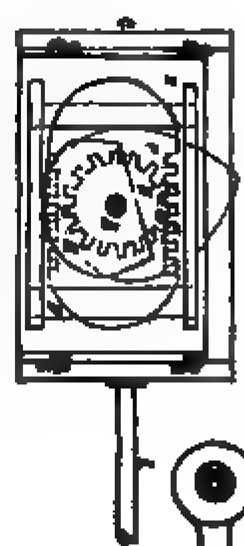


Fig. 13.

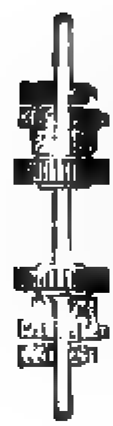


Fig. 7.

Fig. 12.

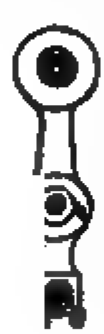


Fig. 11.

pinion H is in gear, on one side of the rack, to the guide J on the opposite side, as a radius, and draw a circle A, as represented in the diagram, fig. 4. Then divide this circle into three equal parts, A B, A C, and C B; next from the point B, as a centre, draw a line cutting the periphery at the point C, and prolong that line towards D. Draw also a line from the point C, as a centre, cutting the periphery in B, and extend also that line towards E. Next draw the chord from D to E. Then all the parts of the circle beyond D and E are to be removed, and the remainder, or shaded part, will give the form required for the cam K.

The cam P, fig. 4[a], is not required to be of any determinate curve; but when an apparatus such as before described, is used as a substitute for the crank in lathes and other like machines, where the propulsive force is exerted in but one direction, the form which I prefer to give this cam is that represented in fig. 5.

Instead of the rack-piece B having only one steam-cylinder piston connected with it, as before described, it may have a piston attached to it at each end, and thus work, or be worked, by a pair of engines at one and the same time.

The two pinions which are used in the preceding rack arrangement to communicate the rotary movement of the shaft to the wheel shaft, may be dispensed with by adopting the modifications shown in fig. 6, which is a side elevation of a rack movement applied to a lath shaft. A is the shaft of the lath; B the double rack, as before; C is a frame, within which B has a limited range of movement from side to side, which is facilitated and regulated by friction guide rollers *a*, *a*, *a*, *a*. K and P are the cams, which, instead of being fixed on a vibrating frame, as in the arrangement before described, are fixed upon the shaft A along with the rack pinion H and P. The form which I prefer to give the cam in this instance is that shown in fig. 5. L is the rod which connects the treadle with the frame C.

In the arrangement represented in figs. 1, 2, 3, and 6, each stroke of the reciprocating piston can but produce one turn or revolution of the wheel, but three or any other odd number of turns of the wheel may be given at each stroke by increasing the length of the rack, and making the other modifications and additions represented in figs. 7, 8, 9, 10, and 11. A A is a framework; B a double rack-piece, which slides on rails R R; D wheel-shaft; G rack pinion shaft, which has its bearings in a vibrating frame E, which is attached by collars to, and turns on the wheel-shaft D; H is the pinion-wheel which works the rack, and K the cam alongside of it, by which the wheel is shifted from one rack to the other; J J are guides in which the cam K moves, which are placed underneath the rails Y Y (the ends whereof are indicated by dotted lines in fig. 8); P is the cam on the opposite side to K, which relieves the apparatus from concussion at each reversal of the line of action, and V V the end stops against which it acts; N is the wheel which transmits the rotary motion of the rack-shaft G to the pinion M on the wheel-shaft; X is a locking or transferring piece, which slides on rails Y Y affixed to one side of the rack; *a* is an oblong aperture in which a bearing piece $a^1$ slides up and down, through which the shaft G is passed; $b^1$ $b^2$ are two bolts, which are respectively moved to and fro by separate bell-crank levers $c^1$ $c^2$, and which, when pressed inwards, protrude across the aperture *a*, either above or below the shaft G; *d d* are springs which press against the bolts $b^1$ $b^2$; $e^1$ $e^2$ are stops attached to the outside of the rails Y Y, which catch against and work the short arms of the bell-crank levers $c^1$ $c^2$, and simultaneously take hold of the projections $a^3$ $a^3$ formed on the bolts in the manner following:—Supposing the pinion H to be in gear with the under rack, the sliding bearing $a^1$ of the shaft G will be at the bottom of the aperture, and kept down by the protrusion across the space above it of the bolt $b^2$, as represented in fig. 10; then immediately on the traverse of the under rack being completed, the short arm of the lever $c^2$ catches against the stop $e^2$, which throws back the bolt $b^2$, and leaves the sliding bearing $a^1$ of the shaft G free to rise when acted upon by the cam K, in order to the change of gearing from the under to the upper rack being effected; while simultaneously therewith the spring *d* forces the bolt $b^1$ into the space beneath the sliding bearing $a^1$, which it keeps up when the change of gearing has taken place from the lower to the upper rack, and until another traverse of the rack is effected, when all the preceding operations are repeated, but in the reverse order, as represented in fig. 11. When the motion of the main shaft is reversed, the projec-

tions $a^3 a^3$ effect the same movement of the parts as was effected by the bell-crank levers $c^1 c^2$. Figs. 12 and 13 are representations of a vibrating frame, the bearings of which are fixed in plummer blocks A A, instead of bearing upon the main shaft, and showing also how an additional pair of driving wheels may be employed when used for engines of great power. The vibrating frame E used in the apparatus last described may be substituted for the vibrating plates employed in the first arrangement.

A reciprocating lifting action may be also obtained from a rotary motion, simply by placing either of the apparatuses before described in a vertical instead of a horizontal position, and applying the steam or other power employed to turn the shaft G of the rack pinion H.

## ON SIR FRANCIS C. KNOWLES'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF IRON AND STEEL. BY SIR FRANCIS C. KNOWLES, BART.

In reference to the specification of my patent processes for the preparation and treatment of the ores of iron, and for the conversion of some of them directly into malleable iron and steel, published in the last Number of this journal, it may not be uninteresting to its readers to be made acquainted with the principles on which more particularly in an economical point of view, as well as chemically, those processes are founded. I was first led into the train of thought which terminated in the most important part of this invention, by the fact that coal in the process of coking, whether in coke-ovens, or in the blast furnace, as raw coal loses a very large portion of its weight in the form of gaseous matter composed chiefly of carbon and hydrogen; and by considering the well-known superior deoxidising and cementing power of these elements in the aëriform state as compared with their solid and crude condition in coke or bituminous coal. This loss is enormously increased by the action of the blast on the materials in the lower parts of the blast-furnace, so much so that Professors Playfair and Bursen, in their very elaborate and exact analysis of the gases evolved from blast furnaces where raw coal is used, compute the waste at 81·54 p., 100 of the entire weight of the coal, to say nothing of the other valuable products equally lost in this branch of manufacture. On the other hand, when we regard the minerals employed in making iron, we find that we have restricted ourselves to a comparatively narrow field, however conveniently situated, and that containing ores the poorest, the most infusible, and the most contaminated with earthy matters; the richer ores, where used at all, entering merely as a subsidiary element, and in quantity comparatively small. Indeed, the very pure ores of iron of Great Britain may be said to be wholly neglected, though in point of richness and purity from all noxious combinations they may challenge comparison with any ores in the world. I have before me samples of iron ore which certainly do not contain 1 per cent. of anything but iron and oxygen. Thus we waste by millions of tons annually carbonaceous fuel purer than any charcoal, as well as more powerful in chemical action, and we neglect minerals of the finest quality which this fuel will reduce; while we depend on foreign countries for oursupply of pure iron for finer purposes, and for the raw material of our steel manufactures, "because," we say, "charcoal is a fuel so dear in this country!" It is to be hoped that this reproach will not much longer attach to a nation pre-eminent for chemical science, and its practical and technical applications. Powerful vested interests are no doubt opposed to a change in the old methods; but the history of the useful arts in Great Britain proves that such interests are, in the long run, powerless when opposed to real and solid improvements. It would be too much to claim such a character for the above processes before they have been submitted to the severe and very proper test of the largest scale of manufacture; but it may not be presumptuous to say that the attempt is in the right direction, and to predict that time and experience will lead to its ultimate success, even though it may be in other, abler, or more fortunate hands. The

attempts of Mr. Clay, of Mr. Heath, and of Mr. S. B. Rogers, of Nant-y-Glo, and others, all men of science and of practical acquaintance with metallurgy in iron, evince a rational conviction in minds best qualified to judge of the probabilities of the case, that the solution of this great practical problem is not only possible, but it may be nearer at hand than we have hitherto supposed. As to the vested interests involved, it is to be hoped that the changes required to be made will be less than at first sight we may be disposed to think, for by judicious arrangements in the modification and adaptation of the present buildings and machinery, the whole effect of the introduction of this new method may be to separate the production of cast iron and of malleable iron into two distinct and independent departments, the coke resulting from the making of gas for the malleable iron-department being consumed in the blast furnace, or cupola, for the production of cast iron. Even the fineries will be applicable to the smelting of the cemented iron ores, so that the coke ovens alone will be displaced or so modified as to serve for kilns to heat the retorts. The habits of the workman also—a very important consideration—will not be much interfered with, the greater part of the changes being in the nature of addition to the present methods rather than of modification of them. I draw attention to these particulars, because it is at all times of the most serious importance to introduce new methods with as little disturbance or shock to existing interests and habits as is compatible with the progress of improvement in the arts. In cases in which the proprietors of new works should confine themselves to the making of malleable iron only, the surplus or residuary coke, after the heating of the retorts and of the puddling and other furnaces, will find a ready market for the use of locomotive engines or railways. The effect on agriculture produced by the saving of the now wasted ammonia from above 300 blast furnaces will be prodigious.

With these preliminary observations, I pass on to the details of the process of cementation by coal gas. The weight of 100 cubic inches of coal gas is about 18 grains, the weight of 100 cubic feet will therefore be $18 \times 12^3$, or in pounds avoirdupois,

$$\frac{18 \times 12^3}{7000}.$$

The gas yielded by 1 ton of good bituminous coal may be taken at 9,200 cubic feet, or $92 \times 100$; therefore the weight of this gas (dividing by 100) will be

$$\frac{18 \times 12^3}{7000} \times 92,$$

or 409 lbs. nearly. We have now to compute the carbon and the hydrogen contained in this weight. The formula which tolerably well represents the composition of coal gas $6\,C + 2\,H$, and therefore the ratios of the carbon weight to the whole, and the hydrogen will be represented by the forms

$$\frac{6\,C}{6\,C+2\,H} \text{ and } \frac{2\,H}{6\,C+2\,H}$$

respectively, and as C is $=6$ and $H=1$, the carbon will be found to be

$$=\frac{36}{38} \times 409 = 387 \text{ lbs.},$$

and the hydrogen

$$=\frac{2}{38} \times 409 = 22 \text{ lbs.}$$

The formula for carbonic acid gas being $C+2O$, the ratio of the carbon to the oxygen required to form carbonic acid will be

$$=\frac{C}{2O} \text{ or } \frac{6}{16},$$

and the oxygen thus taken up will be

$$=\frac{16}{6} \times 387 = \frac{8}{3} \times 387 = 1032 \text{ lbs.}$$

The formula for water being $H+O$, the ratio of the oxygen to the hydrogen will be

$$\frac{O}{H} = \frac{8}{1},$$

and the 22 lbs. of hydrogen will therefore take up $8 \times 22$ lbs. of oxygen. The total of oxygen neutralized will therefore be 1208 lbs. avoirdupois.

The formula for the pure peroxide of iron (we neglect earthy matter for the present) being $2\,F + 3\,O$, the ratio of the iron to the oxygen is

$$\frac{2\,F}{3\,O} \text{ or about } \frac{7}{3},$$

the reduced metal corresponding to 1208 lbs. of oxygen will therefore be

$$=\frac{7}{3} \times 1208 = 2815 \text{ lbs.},$$

or 1¼ tons nearly. The gas now wasted from 1 ton of coals is therefore such as will chemically reduce to a metallic state 1¼ tons of iron. The modifications introduced in respect of earthy combinations are easily computed when the yield of the ore is known. If we take 3 tons of pig iron as the average amount of coal used, *the gas from this* will turn out 3¾ tons of malleable iron, leaving about 2 tons of coke to be employed in heating the retorts and the puddling furnace, &c.: to this is to be added the coal saved in the fining process, its engine, &c. If the ore is a simple peroxide, the coal saved in roasting will have to be added. The computations for the use of carbonic oxide are analogous to the above, and can be readily performed by your readers for themselves.

I shall take an early opportunity, when some experiments on an adequate scale have been completed, of sending you an estimate of the comparative cost of producing bar iron by this and by the present process.

Of the previous cementation of ores intended to be smelted for the production of cast iron, I need only observe that it will be found to lead to a great saving of fuel, and a more uniform working of the furnace, and that by means of it gray metal may be obtained from ores which cannot at present be smelted, or at least smelted alone.

The specification itself sufficiently details the other processes; but there is one on which I will add a few observations, and some formula which will be found generally useful to iron-masters; I mean the use of spathose iron ores as a substitute for limestone. The quantity of lime varies in the different species of these ores, but it is always considerable (I have some in which it rises to 13½ per cent.); it must, therefore, as well as the other earthy matters (in the particular species used) be first carefully ascertained in the ores and in the fuel. The problem will then be solved as follows:—Assume that there are three ores and the fuel to be mixed, or A, B, C, F, and F being assumed as the given quantity for a ton of iron; let $x, y, z, f$ be the weights of A, B, C, F to be used in the aggregate. Let $m_3, n_3, p_3, f_3$ be the per centages of the silica in the four substances; $m_2, n_2, p_2, f_2$ those of the line; and $m_1, n_1, p_1, f_1$ those of the alumina respectively. Then

$x$ will contain of silica...... $m_3 x$
$y$ ,, ,, ...... $n_3 y$
$z$ ,, ,, ...... $p_3 z$;

and the total of silica will be

$$m_3 x + n_3 y + p_3 z + f_3 f;$$

that of the line will be similarly

$$m_2 x + n_2 y + p_2 z + f_2 f;$$

that of the alumina will be

$$m_1 x + n_1 y + p_1 z + f_1 f;$$

and these are (by the rule) to be as 3, 2, 1 in the aggregate of ores and fuel. We have, therefore, the two equations

$$(1)\ \frac{m_3 x + n_3 y + p_3 z + f_3 f}{m_2 x + n_2 y + p_2 z + f_2 f} = \frac{3}{2}$$

$$(2)\ \frac{m_2 x + n_2 y + p_2 z + f_2 f}{m_1 x + n_1 y + p_1 z + f_1 f} = \frac{2}{1}$$

As there are three unknown quantities, and only two equations between them, we require a third for their determination. We may either assume a fixed quantity of one of the ores as a basis, according to convenience, or some practical consideration arising out of its ingredients other than the three earths, or we may introduce some other limitations into the problem. Suppose the condition to be that the metal in the ores shall exactly contain $a\ f$ tons of iron, and be to $f$ as $a:1$, and let the respective per centages be $i_1, i_2, i_3$, then we have the third equation—

$$(3)\ i_1 x + i_2 y + i_3 z = af,$$

from which three equations the required weights may be determined: some convenient proportion of $x, y, z, f$ will then be "*the charge*" for the furnace. If we had four ores to mix, we should have a fourth unknown quantity, $v$, and we should then require another condition by way of limitation on their values: say that the aggregate should contain a given weight of manganese, potash, &c., or any other condition practically desirable.

The equations may be put more conveniently in this form

$$(1)\ (2m_3 - 3m_2)x + (2n_3 - 3n_2)y + (2p_3 - 3p_2)z = (2f_3 - 3f_2)f,$$

$$(2)\ (m_2 - 2m_1)x + (n_2 - 2n_1)y + (p_2 - 2p_1)z = (f_2 - 2f_1)f,$$

$$(3)\ i_1 x + i_2 y + i_3 z = af.$$

If we eliminate $z$ between (1) $x$ (2) and between (2) and (3), we shall obtain equations in $x$, and $y$, and eliminating $x$ or $y$ between these, the value of either, and thence that of $z$ may be found. As no negative values can be admitted, conditions excluding such values must be imposed on the coefficients of $f$ in the final values of $x_1$, $y_1$, $z$, and the ores for admixture selected accordingly.

This may be readily done by inspecting the earthy composition of the ores and of the fuel of which the selection is to be made, and submitting the numbers to trial.

The proportion of fuel being about one-fifth in gaseous matter due to coking, and four-fifths in all being wasted, that appliable as fuel in the form of carbonic oxide to heat the retorts, &c., will be three-fifths; and it may be estimated that with scarcely any additional fuel 3⅗ tons of malleable iron reduced directly may be made for every one ton of pig iron from the blast furnace assuming three tons of coal to the ton of pig iron, as in this process the gas is freed from sulphur, it will bring into use coals which are unfit for making iron from their large admixture with sulphur, but are highly bituminous, and which in the South Wales basin are associated with the Black Band.

## MESSRS. SEAWARD AND CAPEL'S LETTER TO THE ADMIRALTY.

Sir,—Messrs. Seaward and Capel's letter to the Admiralty, on Marine Engines and Boilers, which appeared in a late Number of the *Mechanics' Magazine*, sufficiently explains the fact that no material improvements are to be effected in marine steam engines, either by the Admiralty steam department or private companies. If the answer of Messrs. Seaward and Co. to the three Admiralty questions are to be implicitly followed, there will be no further improvements, and the Government and Steam Navigation Companies will still incur a useless expense of at least *one-half* in their various steam navigation services. The answers to the Admiralty questions were probably prompted by the view which most marine engineers take, viz., that their present practice is the most lucrative,—that they consider it as nearly perfect,—and that it might not be profitable for them to make changes in their system. These are the only correct foundations upon which the answers can rest, and Messrs. Seaward's justification of them is founded upon errors and fallacies which can be easily refuted. Marine engineers cannot deny the economy of land engines, where the steam at *full power* is cut off at one-tenth of the stroke; but Messrs. Seaward deny that these advantages can be realized, *except* in pumping engines. They state, that "the pumping engine is not trammelled by a rotary motion," and "the consequence is, a very great initial velocity is given to the piston," &c. This sort of argument would be suited to those who are ignorant of mechanics, or who suppose that the intervention of the *crank* occasions a loss of power; but it is simply untrue, that a "very high initial velocity" is given to the piston of a pumping engine; its "mass of matter" to be put in motion at every stroke would effectually prevent *that* result; and, in fact, from well-known experiments on the subject, it has been proved, that the piston of a pumping engine does *not* attain its maximum velocity till it has travelled through more than *one-third* of its stroke. The pamphlet under consideration next states, that it will probably be impossible for marine engines to be worked advantageously cutting off at one-sixth of the stroke, from the increased weight of machinery, which would only enable the vessel to carry "little or no fuel," [!] and the greatest extent of expansion to be profitably employed should range from *one-half* to *three-fourths* of the stroke. In refutation of this mass of error, it may suffice to state, that American steam vessels have long used pressures of from 50 to 100 lbs., without rendering their machinery so heavy as to prevent the possibility of carrying fuel; and H. M. ship *Inflexible* has steamed many thousand miles, cutting the steam off at *one-tenth* of the stroke, with a velocity of 7·5 knots, and a mean effective pressure of 7 lbs. per square inch —using only two boilers, with a consumption of 12 tons daily. These engines, at full power, produced a mean effective pressure of 18 lbs.; there is, consequently, no doubt that they could have been constructed considerably

*lighter* if placed on board a vessel of smaller tonnage, and worked at *full power*, cutting off at one-tenth, with half the weight of boilers. But, of course, this system would be a most clumsy one for carrying out the principle of cutting off at one-tenth with full power. The Admiralty are at present having engines constructed of 400 nominal horses power, and a total steam force of 30 lbs. per square inch, or nearly double the pressure of old engines; and yet the strength of the machinery required for this extra pressure has, I will venture to say, not rendered them *heavier* than the old engines of similar power and lower steam pressure.

Messrs. Seaward and Capel forget that there is momentum to be overcome in marine engines, and with an increased velocity of piston the strains upon the machinery can be materially equalized and reduced. A large space is devoted in the pamphlet to the comparison of two engines having the same amount of expansion and horse power, but worked with 40 lbs. and 20 lbs. total pressure respectively. It would, perhaps, be difficult to say which would be the most economical; but the inquiry is manifestly useless, as the only object in the use of high-pressure steam should be to effect a saving in the *quantity of water evaporated*, and at the same time producing an equal amount of power by cutting off at an earlier period of the stroke. But even here Messrs. Seaward and Capel are at fault; for even in theory there can be no economy in the production of high-pressure steam, as what may be gained in comparative *volume* would be probably equally compensated by the superior *latent heat* of steam, as the pressure under which it is raised augments. The only *gain* could be in the smaller per centage of the *condenser* pressure,—a point which I investigated in "The Economy of the Marine Steam Engine."

In the last paragraph, the following rather contradictory statement is found:—"There is no difficulty in making the mechanism of an engine sufficiently strong to sustain the pressure *of steam of any elastic force whatever;* and if we can succeed in discovering a mode of constructing a commodious steam generator of unquestionable safety, there *can be no valid objection* to employ steam of 50 or even 100 lbs. pressure for marine purposes." Such a method as Messrs. Seaward and Capel are apparently in want of, has been in most extensive use for the last fifteen years; and there are at present in *constant* use upwards of *five thousand* steam boilers evaporating steam with perfect safety, under pressures varying from 60 to 80 lbs. per square inch above the atmosphere. I allude to the locomotive boilers in constant use upon railways, and which merely require a due adjustment of *grate surface* to evaporation to render them in every way perfectly adapted for marine purposes. There can be no doubt that they are much safer and less liable to explosion than the common *square* form of marine boiler, with a pressure of 16 lbs. on the valve. One of these boilers would have a girth exposed to a bursting pressure of 40 feet, whilst a locomotive boiler in no case has exceeded 13 feet. Let the explosions of *marine* boilers be compared with those of *locomotives*, and it will be seen how much higher they stand in the scale of safety. In the engine which I have lately registered (seen *ante* p. 1), every point which I believe to be necessary for the fullest development of economy in marine steam engines has been fully carried out, and may thus be briefly summed up:—

1. Expanding the steam when the engine is working at *full power* (with the vessel in proper trim, and fine weather), though *not less* than NINE-TENTHS of the stroke.

2. Using boilers with a load upon the safety-valve of *not less* than *forty-five* pounds per square inch.

3. Using two steam ports and two eduction ports for each cylinder. The eduction ports to be of the *usual* size for the given diameter of cylinders, and the steam ports considerably less, but of sufficient size to permit the elasticity of the steam in the *cylinder* to equal that in the boiler, when cut off at one-tenth of the stroke.

4. The working of the expansion valves by means of a separate eccentric pulley, with a continuous motion, and without the intervention of either *tappets* or *cams*, or irregular movements of any description.

5. The employment of condensers on the cold surface principle, placed apart

from the engines; whereby blowing off is rendered unnecessary, and all incrustation is prevented.

6. The supplying the waste of the *feed water* of boilers from the evaporation of salt water (contained in flat chambers surrounding the funnel), and placing the condensers in the paddle-boxes, with pipes leading to suitable reservoirs in connection with the feed-pumps.

7. Making the amount of grate surface equal to that in engines of equal *nominal* power.

8. Arranging the feed-pipes in a spiral form inside the smoke boxes, for the purpose of raising the temperature of the feed.

9. Forming the steam chest of two concentric cylinders inside the base of the funnel and above the top of the boilers.

10. Protecting the boilers by coal boxes, extending over them to the level of the surface of the water.

11. Feeding the furnaces through an opening in the crowns (in addition to the usual fire doors), from a hopper and rollers, worked by the engine.

12. Setting the cylinders in a fore and aft line, with two cranks placed as close together as possible (leaving the cylinder covers clear).

13. Making the cubic contents of the cylinder equal to *half* the usual size, though exerting *equal* power with, of course, *half* the usual evaporation of water from the boilers; the piston moving with nearly double the usual velocity, at any given power.

14. Employing paddle wheels of the usual size, but making *half* the number of revolutions which the engine does (on the principle of *towing engines*). And,

15. Employing for marine purposes boilers of the locomotive description, with such a grate surface, rate of combustion, and rate of evaporation, as has been usual in marine boilers—thus doing away entirely with the blast pipe.

I am, Sir, yours, &c.,
W. E. A. GORDON,
*Lieutenant R. N.*

London, January 7, 1850.

## THE BOUTIGNY STEAM GENERATORS.

(Patent dated July 4, 1849. Specification enrolled January 4, 1850.

Before proceeding to the description of the apparatuses which form the subject of this specification, it will be proper to give M. Boutigny's explanation of what is meant by "the spherical state of bodies," and what its "peculiar properties" are. A body of water on being projected, in small quantities, and at certain intervals of time, on the bottom of a suitable recipient which is heated to from 400° to 500° Centigrade, while its sides are maintained at a temperature below 142° Centigrade, assumes a rounded or spheroidal form, which remains at a permanent distance from the spheroidalising body; that is, the bottom of the recipient, and reflects radiated heat. Its chemical action is suspended, and its temperature invariable, or confined within very narrow limits—always beneath the boiling point; while the steam, which it throws off at a slower rate than it would do if heated in the ordinary manner, is of the same temperature as that of the spheroidalising surface. The water in contact with the sides vaporises immediately, and, if the recipient is closed, will pass into equilibrium of temperature and pressure with the steam which is continuously given off by the spheroids.

It follows, from what has just been stated, that this system of steam generation is attended with these advantages: First, That a very considerable quantity of caloric and dynamical force may be contained in a very small volume of steam, in consequence of the high temperature and pressure which are given to it in generators of from 50 to 100 times less size than ordinary steam boilers to produce a like result. Second, That the steam formed by the water coming in contact with the sides of a vessel at a temperature below 142° Centigrade, will be raised to a much higher temperature and pressure by the radiation of heat from surfaces heated to above 142° Centrigrade, and by mingling with the steam thrown off from the spheroids. Third, That the quantity of water in the generator may be considerably reduced without diminishing the motive power. Fourth, That the size of the furnace and quantity of fuel consumed may also be reduced, inasmuch as the heat arising

therefrom may be applied first to the bottom of the generator, then to the sides, and lastly to raising the temperature of the feed-water to above 100° Centigrade Fifth, That the chances of danger from explosions are considerably lessened, in consequence of the generator containing only a few quarts of water—a portion in the liquid state and the rest in the spheroidal state, so that should any part of its spheroidalising surface be suddenly cooled down to below 142° Centigrade, a certain known quantity of steam only can be disengaged, the effects of which may easily be provided against.

The purposes to which steam of this high temperature, generated in apparatuses about to be described, may be most advantageously applied, are—the heating of stores and apartments, baths, dyers and scourers' vats, paper-making, silk spinning, cooking, manufacture of soap, distillation of wines, spirits, fatty bodies, and fatty acids; boiling of syrups, sugar refining, extraction of soluble and colouring matters from vegetables, desiccation and baking of clay and other substances; carbonization and revivification of organic substances; fusion of certain metals and other easily fusible products, roasting ores, &c., &c. An apparatus suitable for generating steam in the manner before described, is represented in the accompanying engraving which is a longitudinal view, partly in section, of the machine, one-tenth of its actual size. A, is a cylinder of iron, or other suitable metal, which forms the body of the gene-

rator, and is constructed of a thickness capable of resisting the maximum degree of pressure to which it is to be subjected. A′ is a cover bolted to the flange of the cylinder, and provided with suitable orifices to receive the feed-pipe J″ (placed in the centre), an exit, or surplus-water escape pipe N, safety valve R S, steam-pressure gauge, and steam pipe M. *a*, *a*′, *a*″, *a*‴ are a number of circular concentric grooves or channels of from three-eighths to one-half an inch in width, and twice that in depth; or hemispherical hollows, communicating with each other, which are constructed in the bottom of the generator for the purpose of separating the feed-water. Roughnesses or projecting angles on the surface of the bottom of the generator being unfavourable to the production of the spheroidal state, everything of the sort should be removed by polishing and planing down; and in order to avoid the existence of such angles, and to economize space as much as possible, a portion of the circumference of each hemispherical hollow in the second row is made to take into the space opposite to it between the two chambers of the first row, and so on throughout the series. Or, instead of the preceding, any other convenient form and arrangement of chambers may be employed, provided they divide the water into small portions, and surround each portion with as much of the heated bottom of the generator as may be practicable. B, brickwork or masonry in which the generator is set, and *b b* small flues therein for conducting the heat and products of combustion from the furnace F around the generator, previously to escaping by the chimney D, which is made of sheet iron. C is a casing of sheet iron, which envelopes the brickwork or masonry; E E, standards to support the furnace. G G′ are two feed-reservoirs, constructed in sheet or cast iron, and to be used in cases when the water cannot be supplied to the generator by a pump. H H′ are the supply pipes, and I I′ the discharge cocks of the reservoirs. J J′, two service pipes leading from the reservoirs and uniting in the feed pipe J″; L L′, two pipes provided with stopcocks *l l*, which are united at the point L″, and open into the top of the reservoirs, for the purpose of maintaining equality of pressure between the supply cisterns G G′ and the generator. The double system of supply has for its object to prevent any stoppage in the supply to the generator, for during the time one reservoir is emptying the other is filling. The four pipe,, L L′ J J′, are provided with stopcocks as indicated in the figures, for cutting off or opening a communication between one or other of the reservoirs GG′, and the generator, as occasion may require. N is a vertical pipe, being the prolongation of L″, which terminates just above the top of the grooves or channels. O O O O are circular false bottoms, which are perforated and suspended, one beneath the other, in the interior of the generator. They are moreover provided with roughened edges all round, which serve to retain a portion of the feed-water, which is vapourised by boiling, while the roughness of the sides prevents the spheroidalisation of the water so retained. P P are two tubes which communicate with the lower and upper parts of the generator A, as shown in the figure, and at their other ends with the vertical glass tube Q, for the purpose of enabling the height of water in the generator to be ascertained. V is the weight on the end of the lever of the safety valve, and T the door of the furnace. *gg*′ are vertical glass tubes communicating at top and bottom with the feed cisterns, for the purpose of indicating the height of water therein.

The mode of operation of the apparatus is as follows:—Supposing the fire to be lighted while the reservoir is empty, and thereby heated to between 400° and 500° cent.; the tap of one of the service pipes J, leading from the reservoir G to the feed-pipe J″ is then opened, and the water allowed to flow into and through the false bottoms successively, a portion whereof is thereby vapourised, and the rest falls into the grooves or channels, *a a*′ *a*″, and passes into the spheroidal state. The pressure in the generator is communicated to the feed-cistern G, by the exit-pipe N and tube L the stopcock *l* whereof being opened while the stop-cock *l*′ of the tube L′ is closed; so that the inflow of water is uninterrupted, whatever may be the amount of pressure in the generator, and the feed is rendered self-acting as it were. If from any cause the level of the water projected on the bottom of the generator A rises above the top of the edges of the grooves or channels, it will be imme-

diately driven, by the pressure of steam, into the exit pipe N, and thence into the feed cistern G; otherwise the water will remain in the pipe, whence it will fall, little by little, until equality of pressure is established between the feed cistern and the generator, and the level of water in the latter is somewhat below the top of the grooves or channels. It will be seen from the preceding observations that the pipe N has to perform two functions; first, to maintain an equality of pressure in the generator and feed cistern, in order that the inflow of water may be uninterrupted; and, second, to regulate the level of the spheroidalised water. When the feed cistern G is emptied; the cocks which establish communication between the top and bottom thereof, and the generator A, are shut off; the cocks of the pipes L′ J′ are turned on; and a similar communication opened between the top and bottom of the feed cistern G′ and the generator A. This peculiar construction and arrangement admits of the supply of feed water being diminished or stopped altogether without incurring any danger, a circumstance which favourably distinguishes this from ordinary steam generators; the only result being a proportionate decrease in the steam given off, which may, however, be re-established by opening one of the feed taps. In the case where the supply of water is too great, the exit pipe N will maintain it at a level beneath the top of the grooves or channels, and, consequently, prevent the dangerous results which would ensue if it overflowed them. In order to diminish the chance of danger from explosions, the cover A′ is constructed to resist a somewhat lower degree of pressure than the cylinder A, so that it may be the first to give way; in which case it will be necessary only to replace the injured cover, whereas any rupture of the cylinder would be attended with disastrous consequences. And, as a further precaution, the generator may be placed in the lower part of the chimney.

The patentee next describes a modification of this steam generator, in which the false bottoms are replaced by the spiral wire gauze tube, into which the feed water is supplied. Part of the water in flowing through the spiral tube is vapourised, and in the form of steam allowed to escape through the reticulated surface of the tube, while the remainder falls into the grooves or channels constructed in the bottom of the generator, as explained in the preceding description. Another modification consists of a double cylinder arrangement, in which the heat and products of combustion are caused to pssa inside and outside the main cylinder, whereby the extent of heating surface will be considerably increased. The bottom is constructed with grooves or channels as before. Inside the generator is suspended a false bottom, similar to those shown in the engraving, which receives the feed water in the first instance and allows it to fall into a tube, similar to the spiral tube, before described, whence it passes to a gutter, which conducts such portion as may not have been vapourised in its passage to the grooves or channels, where it passes into the spheroidal state.

Instead of any one of the preceding arrangements, it is proposed to employ a number of cylinders placed at right angles to a receiving cylinder, into which the feed-water is supplied from several points, and whence it runs down the slightly inclined bottoms of the cylinders. During its transit, a portion of the water passes off in the form of steam, and the rest passes into the spheroidal state onits arriving at the hemispherical-shaped ends of the cylinders which are exposed to the greatest amount of heat. Rectangular perforated metal trays may be placed in the cylinders, for the purpose of increasing the heating surface. When it is desired to maintain the generator at a constant temperature, a bath of metal, or of some of the fusible alloys, or of metallic filings, or other substances in powder, may be employed as a heating medium between the generator and the furnace.

For claims, see p. 38.

## THE EXHIBITION OF THE WORKS OF INDUSTRY OF ALL NATIONS.

(Continued from page 34.)

We are staunch friends of free trade; but we make a great distinction between leaving trade entirely free—which we take to be the true policy—and stimulating trade *to make free*. We would no more encourage home industry by bounties—the folly of which has long since been acknowledged by the wisest men of all parties—than we would

encourage foreigners by bounties to come and take the bread out of the mouths of our own people. The Dutch should for us, fish in our waters unmolested and ungrudged, and have free access also to our markets for the sale of the produce of their industry; but we should not think we did right by our own native fishermen if we were to hold out to the Dutchman, a bounty *beyond the fair market price of his commodity*, for leaving his own shores and markets for ours. So, also, we would cordially extend the rites of hospitality to every foreigner who came of his own accord amongst us, to work for his bread, willing and well content to bear the same burdens as ourselves, for the sake of the greater privileges and advantages the working people of this country enjoy compared with others; but were the Government to take a sum of money out of the purse of the commonwealth, and offer it in premiums to the artizans of all other nations to come and do their best, to push our own artizans from their stools—this, we should say, were downright insanity,—not acting up to the principles of free trade at all, but acting in flagrant violation of them, to the present injury and possible ruin, of every home interest which it is the duty of Government to promote and cherish.

Now this is precisely what the promoters of the approaching Exhibition are intent on doing, with the sanction of the Court, at least, if not of the Government. Not content with throwing the doors open to all the world—to which we have no objection whatever—they have resolved on *tempting* all the world to the competition, by the offer of a sum of money, in prizes, larger than was ever offered before for the same purpose in the history of nations. "Come and beat our artizans, if you can; destroy, if you can, the credit of their productions in all the markets of the world; do so, and welcome: and, lest any of you should be too poor to bear the charges of foreign travel, we will not only pay your travelling expenses, but, *if you succeed in thus supplanting the native industry of the country*, we will give you a handsome premium into the bargain." Such is virtually the language addressed by the getters up of this Exhibition, with Prince Albert at their head, to the artizans of all other nations. Prince Albert—himself a foreigner—who takes this way of identifying himself with the interests and feelings of the people of whose Queen he is the honoured consort!

Some there be, who deem national distinctions a folly, and universal brotherhood the only true social policy. But give us, ten times rather, that practical wisdom, which teaches every one to prefer the welfare of his own family to that of all other families—of his own country to that of all other countries. Be every people only true to themselves, and all the world will then be sure to do what is best for each and for all.

Some there be, too, who are ever prating about the pitch to which "high art" has been carried in foreign countries, and the great benefit our artizans would derive from a large infusion of it into their productions. We do not know any term which has been more abused than this of "high art." It is become, in fact, the distinctive name for a species of "cant" as vile as any existing. We have always observed that those who delight in it most, are precisely those who know least of the true principles on which beauty or grandeur in art consist. With a great many, everything that is outlandish is "high art" in perfection—everything of home production utterly contemptible: this, indeed, is one of the grand foibles of the day. Now, in the first place, we do not admit that our artizans are so much behind those of foreign countries, in matters of taste as is pretended—*if at all*; and, in the second place, assuming the fact to be as represented, we deny that it establishes any necessity for an inundation of foreign workmen to be their teachers. All that is to be learned from foreigners is to be learnt from an inspection of their productions; and of these there is already an abundance everywhere, thanks—sincere thanks—to Free Trade, which, without bounties, premiums, or artificial stimulants of any sort, has

already attracted to our markets, the best of everything of every country of the habitable globe.

Besides, the effect of holding out such artificial temptations to foreigners, will not be to attract to the Exhibition articles of "high art" alone, but to produce a vast influx of foreign trashery of all sorts, which will remain after the exhibition is over, to be sold at any price it will fetch—driving for the time, by the force of mere cheapness alone, the produce of our own workshops out of the market, and bringing distress, if not ruin, upon our hard-working and sorely-taxed workmen.

Would you then confine the Prizes to native exhibitors alone? By no means. WE WOULD HAVE NO PRIZES AT ALL. Native, as well as foreigner, should have no other inducement to exhibit than the larger opportunity which such an exhibition would afford him of making his skill and ingenuity known to the world. Greater inducement is not wanted, and anything beyond is not only superfluous, but mischievous.

For these, among other reasons:—First, because it is practically impossible to make such a selection of judges, as would have the confidence of exhibitors or the world at large. If you are to admit all nations to the competition, then you ought according, to the analogy furnished by our criminal jurisprudence, to have a jury of half natives half aliens. But to find a dozen or twenty men of sufficient repute for such a jury—the alien half especially — would be no easy matter; and if found, the very circumstance of their diverse nationalities would be made a pretext of, to disparage and decry all their decisions. Every foreigner who failed to carry off a first prize, would be sure to protest that he had lost it only because of the native half of the jury being prejudiced in favour of their own countrymen, and pulling altogether in support of them; while every Englishman in the same plight would as stoutly maintain that he had been doubly sacrificed—first, to the anti-English feelings of the "foreigners" among his judges; and next, to the false taste which prevails among his own foolish countrymen for everything foreign.—Both, perhaps, equally in the wrong, but both equally clamorous and inappeasable. For every approving voice there would be at least ninety-nine angry remonstrants; and for many a long day after the Exhibition, the public ear would be filled with the growls of the disappointed and the bickerings of the winners and losers of the prizes among themselves.

Second.—Because prizes for superiority in the manufacture of any article can only be fairly and justly awarded, on the supposition that all the manufacturers of that article, or the majority of them, compete for the prize; and of this there is not, in the present case, the slightest chance. If many keep back from the competition, you cannot be sure that the best of those who do exhibit is not, after all, a miserable botcher compared with those who have disdained the contest. Let us suppose, for example, that one of the prizes should be for the best steam-boiler. We may be sure that there would not be found among the competitors for such a prize either a Maudslay, or a Field, or a Miller, or a Penn, or a Seaward, or a Fairbairn, or a Napier; and in the absence of these makers, and others of like mark, the prize would possibly enough fall to the lot of some pot-and-kettle engineer, who never made a steam-boiler in his life, and who is ignorant of all the science that goes to the making of a good one. With what esteem could the world be expected to regard a prize awarded under such circumstances? Would any one of the distinguished makers we have named, receive one order the less because of the spurious honours carried off by him of "the pot-and-kettle?"

We shall perhaps be told that prizes have worked well in other instances, and that it is therefore but fair to suppose they will work well here. No doubt, too, we shall be referred for proof to the histories of the Society of Arts and of the Royal Agricultural Society. We deny that prizes have worked well in either case. For the former society, they have acquired a character for triviality and inutility, which no possible career of future usefulness is ever likely to efface; in

the latter they have given rise to so many heart-burnings, to so much squabbling, and to such general dissatisfaction, as to have produced a fast-growing conviction among its leaders that the prosperity of the Society will be best consulted by their entire abandonment. We appeal for the truth of this latter statement to the correspondence on the Society's files; to the members of the council, who if they vote collectively as they individually and privately express themselves, will, by a large majority, confess that we speak but the simple truth.

Again; it would be easy to show, from the history of other Exhibiting Societies, that prizes are not at all necessary to the most complete success. Look at the Royal Academy. Every year it attracts to its rooms the best productions of the studios of all England, without the offer of a single prize; the exhibitors are but too glad to have their works thus brought under the notice of the public without caring for anything more. Here, indeed, is a case so completely in point, that it settles the whole question; for we defy any one to show that it can make the slightest difference as regards the *inducement to exhibit*, whether it is a work in the useful or in the fine arts which a man desires to make known. Publicity is all that is wanted in both cases.

Who, then, upon the whole, can doubt that the *Times* (of other days) was right in saying, that "*the public will always be found the best patron of the useful arts, the consumer the best judge, the shops of a great city the best National Repository, and a ready sale with prompt payment the best premium of encouragement?*" Who can say, that it detracts in the least from the force of these observations, that the forthcoming Exhibition is to be open to all nations, and the prizes to all competitors? Is not the "public" the best judge and patron of foreign as well as native productions? Why seek to set up any tribunal superior to it? Why attempt to force patronage and custom into any other, than their natural and accustomed channels? Why offer stimulants where none are wanted? Why meddle, when the experience of the world has shown that all such meddling ends but in failure and mortification?

*Proceedings of the Commission.*

The Royal Commission for promoting the Exposition of Industry and Arts in 1851, held its first sitting, in the New Palace at Westminster, yesterday (Jan. 12). Prince Albert came to town on purpose to preside, and the assemblage of Commissioners was numerous. The contract made with Messrs. Munday was the chief matter discussed. It was deemed "strictly reasonable and very liberal;" but "public opinion having been so strongly expressed in favour of the Exposition as to render any such contract now quite unnecessary," the Commission "decided to give notice of its termination." —*Spectator, Jan.* 12.

So, then, the first act of the Commissioners has been to ignore the most important of all the considerations recited in the Commission under which they act. It was not true, as shown in our last, that the Society of Arts have invested 20,000*l.* to be awarded in Prizes. The Queen had been allowed by her "right trusty and well-beloved cousin" Sir George Grey, to put the sign manual to a positive untruth; and now it is not true of any body—either corporate or sole—that he, she, or they, has or have invested 20,000*l.* for any such purpose. It is all a phantom. The 20,000*l.* has still to be got. The Commissioners won't have it from Messrs. Munday, because it would be shabby for a nation to go partners in a dirty job; but "public opinion has expressed itself so strongly in favour of the Exposition," that they think they may depend on getting it in some other way. By Subscriptions?—Never. By a Parliamentary grant?—Incredible.

At all events, till the money is raised somehow or other, there can be no offer of prizes; and thus there is an end put at once to the worst part of the whole project. Such a sum may possibly remain out of the proceeds of the show, after all the expenses are paid; but no one can tell,—there may not be a shilling left to divide.

Now that the Commissioners are done with Messrs. Munday, we suppose they will have done with Mr. Drew next, who was placed on the Executive of Five for the

purpose of protecting the Munday interest, but has, of course, no longer any business there. Mr. Drew may tell them, indeed, that they have no power to displace him,—that he derives his appointment from the Crown, and not from them. That is true; and if Mr. Drew likes, he may stick to his seat in spite of them. If all be true that we have heard, the seat is one worth sticking to.

The Commissioners are understood to have been much influenced in the resolution they came to, by a communication made to them from Manchester, through the medium of Mr. Cobden, who is one of the Commissioners, and who was present on the occasion. The substance of it may be gathered from the following Manchester paragraph, which we take from the *Times* of Monday last:—

MANCHESTER, Jan. 12. — Preliminary proceedings have been taken in this city in reference to the great Exhibition of Arts and Manufactures to be held in the metropolis, under the auspices of His Royal Highness Prince Albert, in the year 1851. The Manchester Committee has been nominated. These nominations were made at a private meeting held in the Mayor's parlour at the Town-hall, on which occasion a desultory conversation took place, which showed that the gentlemen present *were by no means satisfied with the conduct of the London management*. The chief ground of complaint was, *the unseemly haste with which the London proceedings had been conducted*. It was stated, that on the 6th of November last, the deputation appointed by Prince Albert met a numerous assembly of merchants and manufacturers of Manchester and the neighbourhood, convened by the Mayor, for the purpose of explaining his Royal Highness's design, and of receiving the opinion of the inhabitants of this great seat of practical art and manufactures thereon. The assembly then convened were disposed to discuss various details as to the plan; but the deputation, it was alleged at the meeting on Thursday, rather checked than invited discussion, on the ground that nothing had yet been determined upon in London beyond preliminary matters, and that no final arrangements would be adopted till the whole country had pronounced upon every point. Mr. Cole, one of the deputation, said, "We shall, in a short time, send you a form which will include every particular in a tabularized manner; and, after the Prince has caused these forms to be collected in, then will every point be settled conformable with the opinions thus collected, and Manchester, as you may suppose, will have much weight in the decision." It was further stated at the meeting on Thursday, that on the 7th of November (the day after Mr. Cole thus spoke), the contract was signed in London with the Messrs. Munday for erecting the building in which the exposition is to be held, and for providing 20,000*l.* for prizes; and hints were thrown out that these arrangements had been determined upon several weeks before that period. Only one opinion was expressed at the meeting in reference to the contract entered into, *and that was in reprobation of the haste with which it had been made, and of the principle of a private contract in a great national undertaking, designed to bring forth the art and industry of the entire kingdom.* The language used by the speakers was strongly condemnatory of the contract affair, *which, if not an actual job, was considered to be somewhat approaching to it.* A resolution, expressive of these opinions, was unanimously adopted, and ordered forthwith to be forwarded to the Central Commission in London.

## INSTITUTION OF CIVIL ENGINEERS.

[From the Inaugural Address of Mr. Wm. Cubitt, who has been Elected to succeed Mr. Field as President of this Institution.]

"Although during the past year there has not been so great a demand for the talents, or the energies of engineers, several remarkable works have been finished, or have far advanced towards completion; I will allude briefly to a few of them, and if others of importance escape notice, it must be attributed to the engineers not having brought accounts of them before the Institution, or even incidentally mentioned them in the discussions. Among these, the tubular bridges across the river Conway, and the Menai Straits, are pre-eminent, for the boldness of the conception, the scientific simplicity of the design, and the difficulty of the execution. In tracing the original idea of the most advantageous disposition of a certain amount of material, in a tubular form; the more definite conception of a hollow beam, to permit the passage and support the weight of an engine and train; the experiments for determining the proper distribution of the material, to prevent compression, or disruption; the arrangements for the construction and building up these gigantic masses of material; the means of floating them to their situations, and of raising them to their ultimate destination, at an elevation of 102 feet above the sea (at high water of spring tides);—we must feel justly proud of possessing among us the man whose comprehensive mind could originate this magnificent design, and so suc-

cessfully perform a portion of the work as to leave no doubt of its ultimate accomplishment. The world already duly appreciates this great undertaking, and we should not be behind hand in testifying our estimate of the bold conception of Mr. Robert Stephenson, in the original idea, his professional skill in the design and execution, his care and caution in availing himself of the talents and experience of Mr. W. Fairbairn and Mr. Eaton Hodgkinson (whose scientific investigations, respecting the strength of cast iron, are so well known to the world, and so highly appreciated by our profession), and his intrusting the general construction and elevation to Mr. Frank Forster and Mr. Edwin Clarke.*

"Upon the merits of all these gentlemen we may look with pardonable pride and partiality; their labours speak for themselves. However advantageous may be the results of this construction in facilitating an important communication, it has already been extremely useful in directing attention to the more general employment of wrought iron for purposes to which it had not previously been deemed applicable; and it will be found that its introduction to structures of all kinds will become more common, exactly as the method of using it becomes better understood. In the year 1847 a Commission was appointed (of which I was named a member), for the purpose of inquiring into the conditions to be observed by engineers, in the application of iron, in structures exposed to violent concussions and vibration; and for endeavouring to ascertain such principles and forms, and to establish such rules as should enable the engineer and the mechanic, in their respective spheres, to apply the metal with confidence, and should illustrate, by theory and experiment, the action which would take place, under varying circumstances, in the iron railway bridges which had been erected. Numerous witnesses of great theoretical attainment and practical experience were examined before the Commission, and a very interesting series of experiments was carried on for ascertaining certain points relative to the compression and extension, the tensile and crushing strength, the effect of statical pressure, and of vibration, concussion, &c. The result of this laborious investigation is (in the words of the Report, which will shortly be made public), that 'considering that the attention of engineers has been sufficiently awakened to the necessity of providing a superabundant strength in railway structures, and also considering the great importance of leaving the genius of scientific men unfettered for the developement of a subject as yet so novel and so rapidly progressive as the construction of railways, we are of opinion that any Legislative enactments with respect to the forms and proportions of the iron structures employed therein would be highly inexpedient.' The Harbours of Refuge now in progress are works of national utility. Those at Dover and in the Channel Islands, by Mr. Walker, deserve particular attention. The former has already produced extraordinary effects on the littoral currents and in the movement of the shingle on the coast, and the latter will afford protection to the storm-driven mariner, where he before expected only danger and death. The breakwater off Portland Island is important, not only as utilizing one of the finest bays on our coast, but also as an immense engineering work, intended to be executed almost entirely by convict labour, and on that account it was not necessary to render its construction as simple as possible. This has been achieved by Mr. Rendel, whose design is to form along the site of the intended breakwater a timber staging, carried upon screw piles; on this will be laid railways connected by inclined planes with the quarries on the hill, whence the trains of stones will be brought, and their contents be distributed simultaneously, and in regular thickness over given areas, enabling a careful admixture of large and small materials to be effected, and the whole mass to rise gradually to the surface; and being thus self-supporting, to prevent the washing away of the materials, which has been experienced in other works of a similar nature.

*(To be concluded in our next.)*

* Our readers are aware that we differ widely from Mr. Cubitt in his estimate of the respective merits of the persons engaged on the work (see vol. LI., p. 12).—ED. M.M.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 17, 1850.

GEORGE COTTAM and EDWARD COTTAM, Winsley-street, Oxford-street, engineers. *For improvements in machinery for cutting straw, clover, and hay; for grinding, for sawing wood, and in apparatus for ascertaining the power employed in working machines.* Patent dated July 12, 1849.

1. Messrs. Cottam's improvements in "machinery for cutting straw, clover, and hay," are embodied in the following arrangement:—A vibrating beam, which is supported in the lower part of the framework, and actuated by a connecting rod from the axis of the fly-wheel, is made to commun cate a rising and falling motion to a horizontal lever, which is supported at one end by a pin in the side of the box, and rests at one point of its length upon a screw and nut,

whereby the distance to which it falls may be regulated. The other end of the lever is furnished with a link and ratchet, which takes into a ratchet-wheel keyed on the axis of the under feed roller, and causes it to revolve intermittently. This intermittent rotary motion is communicated to the upper from the lower feed roller, by the intervention of toothed gearing. The length to which the horizontal lever is allowed to fall regulates also the dip of the ratchet, and consequently the portion of revolution of the feed rollers, that is, the length of straw which will be delivered at each partial revolution. To give a drawing action to the cutter, it is attached to a slotted frame, to which is fastened at right angles another slotted frame, and in each frame is an eccentric at right angles to the other eccentric. The first eccentric gives a horizontal, and the second a vertical motion to the cutter. In order to avoid the necessity of the cutter bearing against the front edge of the box, a ledge is provided, on which the ends of the straw rest.

2. The improvements in "grinding" do not relate so much to the grinding as to regulating the supply of grain to the mill-stones. The patentees make use of a chamber, separated from the hopper by an adjustable slide underneath, which contains a circular plate, driven by a band and pulleys, having cups attached to the periphery, which, as they arrive at the bottom of the chamber, take up a portion of the grain, and when they arrive at the top, empty themselves into a shoot, which conducts to between the mill-stones. One or both mill-stones may be made to revolve as required.

3. The improvements in "sawing wood" consist in supporting the saw in the frame, by means of set screws, which slide on guides at top and bottom, and working it by connecting rods and a vibrating beam from any suitable mover. (What is this but Mr. Cochran's invention over again?)

4. The "apparatus for ascertaining the motive power employed in working machines," is composed of a plate, on which a circular spring is attached by one end, while the other is made fast to a lever connected to the handle. The lever is also attached to a pointer which moves over a scale, whereby the power exerted will be indicated. The pointer also carries a pencil, which travels over the top of one of a pair of cylinders, round which a roll of paper is wound, the curve described on which will indicate the force applied. The cylinders are made to revolve by toothed gearing.

*Claims.*—Each of the preceding methods as described.

ROWLAND BROTHERHOOD, Chippenham, Wilts, railway contractor. *For an apparatus or mode of covering trucks and wagons on railways, road wagons, and canal boats, so as effectually to protect goods in the course of public transit from theft or damage, and, at the same time, to allow of such trucks and wagons being loaded and unloaded.* Patent dated July 18, 1849.

The patentee describes and claims:—

The covering of trucks, wagons, and boats, with a covering supported on longitudinal bearers in combination with radial arms, with or without compound joints. [The covering is composed of canvas or some flexible waterproof material, and the longitudinal bearers which extend lengthwise of the carriage are supported in the forked ends of two sets of radial arms which turn at their lower ends upon two common centres, each of which is fixed in the fore and aft end of the wagon, so that the cover may be opened from either side to the other, as required. The cover is kept over the contents of the wagon by four cords attached to the corners, and made fast to linch-pins in the sides of the wagon.]

GEORGE AUGUSTUS ROBINSON, Long Melford, Suffolk, gentleman; and RICHARD EGAN LEE, Glasgow, gentleman. *For certain improvements in the manufacture of bread, and in the machinery and apparatus to be used therein; and also improvements in the regulation of ovens and furnaces, part of which improvements are also applicable to other similar useful purposes.* Patent dated July 10, 1849.

The patentees describe and claim,

1. The application of carbonated or aërated waters in the manufacture of bread.

2. A peculiar construction of machine which mixes the flour, kneads the dough, and cuts and moulds it into shape.

3. The baking of bread and biscuits, roasting coffee, &c., &c., by applying surcharged steam, and the use of a pyrometer or heat regulator, which consists of a bar of metal, one end abutting against a lever in connection with a throttle-valve in the steam supply pipe, which as it expands by the increased temperature of the oven or furnace, will have the effect of diminishing the supply of surcharged steam thereto.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Matthew Urlwin Sears, of Burton-crescent, St. Pancras, commission agent, for the improved construction of guns and cannons, and manufacture of cartridges for the loading or charging thereof. January 11; six months.

Samuel Newington, of Knole, Frant, Sussex, doctor of medicine, for improvements in sowing, manuring, and cultivating land, and in certain of the implements used therein. January 11; six months.

Bennett Alfred Burton, of the firm of Bennett, Burton, and Burton, of John's-place, Holland-street, Southwark, engineer, for certain improvements in apparatus connected with sewers, drains,

and cesspools, also in suction and delivery pipes, and in connecting such pipes or hose—the apparatus connected with sewers, drains, and cesspools, being applicable to other like purposes. January 11; six months.

John Fayrer, of Surrey-street, Strand, commander in Her Majesty's Navy, for improvements in steering apparatus January 11; six months.

Alfred Cooper, of Romsey, Hants, grocer, for improvements in steam and other power engines, and in the application thereof to motive purposes; also in the methods of, and machinery for, arresting or checking the progress of locomotive engines and other carriages. January 11; six months.

James McDonald, of Chester, coachmaker, for certain improvements in the method of applying oil or grease to wheels and axles, and to machinery, and in connecting the springs of wheel carriages with the axles or axle-boxes. January 11; six months.

John Glasgow, of Manchester, engineer, for certain improvements in machinery or apparatus for shearing, shaping, punching, and compressing metals. January 12; six months.

John Milwain, of Manchester, joiner, for certain improvements applicable to the closing of doors, windows, and shutters. January 12; six months.

Andrew Barclay, of Kilmarnock, North Britain, engineer, for improvements in smelting of iron and other ores, and in the manufacture or working of iron and other metals, and in certain rotary engines and fans, machinery, or apparatus as connected therewith. January 15; six months.

Richard Smith, of Clitheroe, Lancaster, manufacturer, for certain improvements in looms for weaving. January 17; six months.

Henry Cowing, of Stamford-street, Blackfriars, gentleman, for improvements in obtaining motive power, and in steam and other ploughs, in land carriages, in fire-engines, in raising water, for draining, and other agricultural purposes, and in apparatus for evaporating saccharine and other liquors. January 17; six months.

Joseph Nye, of Mill-pond Wharf, Park-road, Old Kent-road, engineer, for improvements in hydraulic machinery; parts of which machinery are applicable to steam engines and machineery for driving piles. January 17; six months.

William George Henry Taunton, of Liverpool, Lancaster, civil engineer, for certain improvements in obtaining and applying motive power, and in a means to ascertain the strength of chains and ships' cables. January 17; six months.

Robert Barbor, of Chatham-place, Lock's Fields, Surrey, metal melter, for certain improvements in artificial fuel, and in machinery used for manufacturing the same. January 17; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Jan. 10 | 2144 | James Parkes and Son, | Birmingham | Rule. |
| ,, | 2145 | Williams and Son | Birmingham | Snuff-box. |
| ,, | 2146 | Myer Myers | Birmingham | Penholder. |
| 11 | 2147 | George Cubitt | North Walsham | Hand power for winnowing, threshing, and chaff-cutting machines. |
| 14 | 2148 | William Henry Muggleton | Tottenham | A type frame. |
| ,, | 2149 | Louis R. Bodmer | Manchester | Door-spring. |
| ,, | 2150 | Westhead and Co. | Manchester | The respirator cravat or fog repellant. |
| 16 | 2151 | Blackburn and Higgin, | Bethnal Green-road | Fronted vest for gentlemen and ladies. |
| ,, | 2152 | George Jacobs | Cockspur-street | Fan riding-whip. |

## MR. GARRETT—MR. BADDELEY.

We have received Mr. Baddeley's explanation: he retracts nothing, but persists in his charge—though without offering a single proof of it worth a straw. Having already expressed our own firm conviction that the charge is unfounded, we cannot consent to be the medium of repeating it in another form.—We must, therefore, decline inserting Mr. Baddeley's letter, though not without deep regret that so old and valued a correspondent should have imposed this necessity upon us.

## CONTENTS OF THIS NUMBER.



LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1381.] SATURDAY, JANUARY 26, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## PLANT'S PATENT IMPROVEMENTS IN MAKING BAR OR WROUGHT IRON.

Fig. 3.

Fig. 4.

Fig. 1.

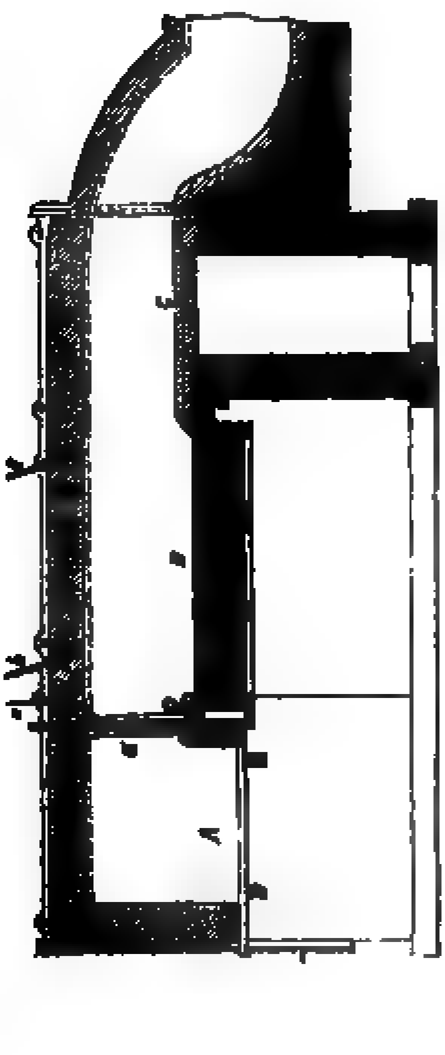


Fig. 2.

## PLANT'S PATENT IMPROVEMENTS IN MAKING BAR OR WROUGHT IRON.

[Patent dated July 18, 1849. Patentee, Reuben Plant, of Holyhill, Coalmaster. Specification enrolled January 18, 1850.]

The special object of this invention is the regulation of the heat employed in the manufacture of bar or wrought iron during the process called "puddling."

*The Specification.*

Figs. 1 and 2 show my improved puddling furnace. A and B are the fire and puddling chambers repectively of the puddling furnace in general use. D is the bridge between them.; C is a preparatory chamber to receive the metal before it is required in the puddling chamber. The preparatory chamber C, is open to the puddling chamber B, without a bridge between them, and the bottom of the preparatory chamber is above the highest stage of the metal in the puddling chamber. E is a damper (which I prefer to be a water or fire-brick damper), to be drawn up, or let down, so as to open or shut the communication between the fire and puddling chambers. The pipes marked *a a a*, *b b b*, *c c c*, show the position and direction of holes, pipes or tuyeres, made or placed in the top of the furnace, *a a a*, being for the introduction of atmospheric air, by hot or cold blast, and *b b b*, for the introduction of steam into the puddling chamber; *c c c*, are like tuyeres for the introduction of steam into the preparatory chamber. I have found two lines of tuyeres across the top of the puddling furnace, three in each line, and each tuyere 1 inch in diameter (the line nearest the chimney being steam tuyeres, and the other line tuyeres for the blast), sufficient for a puddling furnace of the ordinary dimensions, and three steam tuyeres of like size in a line across the top of the furnace, sufficient for the preparatory chamber. These tuyeres respectively may form an angle of about 60° with the top of the puddling furnace (as shown in fig. 1). The blast and steam jets, through their respective tuyeres, may be produced in any way most convenient, as long as the blast is about the pressure of 1 lb. and upwards, and the steam about the pressure of 10 lbs. and upwards upon the square inch; but the blast (by the tuyeres, *a a a*), should be introduced at the top of the puddling chamber, just within the bridge D of the fire chamber in a slanting direction, so as to drive the flame as it enters the puddling chamber down upon the whole surface of the iron, and the steam (by the tuyeres, *b b b*) should be introduced as near as possible to the same place, so as to fall in like manner at once upon the whole surface of the metal in the puddling chamber, and the steam (by the tuyeres, *c c c*) should be admitted just over the division between the puddling and preparatory chamber, so as to fall in the same manner upon the whole surface of the metal in the preparatory chamber. These tuyeres, *a a a*, *b b b*, might be placed obliquely in the sides of the fire chamber, or puddling chamber, or on the top of the furnace nearer its end than the division of the puddling chamber and the fire chamber, and the tuyeres, *c c c*, obliquely in the sides of the preparatory chamber, so as to drive the flame and steam down upon the surface of the metal in the puddling and preparatory chambers respectively, but not as effectively as in the positions I have chosen.

By these arrangements, or improvements, I can regulate with great nicety the heat in the puddling and preparatory chambers respectively without the damper, usually inserted in the chimney or draught of a puddling frame; this damper being a very awkward way of regulating the heat of a puddling chamber, and useless for that object when a preparatory chamber is added.

My invention is as follows:—

Chambers used as A and B, are to be charged and tended with fuel and metal respectively in the usual manner, and the blast of the tuyeres, *a a a*, as well as the usual draught put on. When the metal in B is melted, the blast is to be shut off, and the steam through the tuyeres, *b b b*, put on until the iron boils. The steam is then to be turned off, and the blast put on, until the iron shows itself above the cinder. At this stage of the proceedings the blast should be shut off, and the metal finished by the ordinary draught in the usual manner, or the heat may be increased or lowered if requisite, as already described; the damper E, over the bridge D, is to be raised or dropped from time to time, to aid or check the heat of the puddling chamber as

may be needed. I prefer using hot blast with white, and cold blast with grey iron, though either blast with either iron may be used with advantage. About the time when the iron in the puddling chamber is to be formed into balls, the iron next intended to be puddled should be placed in the preparatory chamber, and kept just below the melting point, by the use from time to time of the steam from the steam tuyeres, *c c c*. As soon as the puddler has emptied the puddling chamber of iron, he is to push with his robble the iron from the preparatory chamber into the puddling chamber. The preparatory chamber is then to be replenished with iron, at about the time when the iron is ready to be formed into balls in the puddling chamber as before. The puddler will stir about the metal in the puddling chamber with his robble, and will judge of the heat of the furnace and of the state of the iron during these several processes in the same way as under the system now in use.

My invention may be applied to the ordinary puddling furnace without much alteration or expense, as shown in figs. 3 and 4, where *a a a*, *b b b*, show the blast and steam tuyeres, respectively applied to the puddling chambers B and E, the damper, instead of the ordinary damper in the chimney of the furnace. The other letters, show the same parts of the furnace respectively, as they do in figs. 1 and 2.

## MATHEMATICAL PERIODICALS.

(Continued from page 486, vol. li.)

### XIX.—*The Stockton Bee.*

*Origin.*—The first number of this periodical was issued at Stockton, under the title of "The Stockton Bee; or Monthly Miscellany for January, 1793." In the opening article "On Authors," the editor remarks, that "the number of periodical works which is now published affords an opportunity of being delivered of literary bantlings without the parents being known, except through their own choice; and to diffuse this benefit more generally, a new FOUNDLING HOSPITAL FOR WIT is erected at STOCKTON, wherein all fond parents are invited to deposit their literary offspring, without the fear of censure, as the strictest secresy will be observed, and the utmost impartiality shown;" and so well did the literary and mathematical public support this "Foundling Hospital," that at the close of the year it was thought advisable to enlarge the work so as "to make the next volume more respectable in its appearance." The work was continued under its enlarged size until December, 1795, when an "Advertisement" announced that "the publication of the *Stockton Bee*" was, "for the present, suspended;" and the *reason* for its discontinuance is abundantly evident when the editor "hopes that the present suspension of the work may be of service in cooling the too great fervour of those, who, not thinking it possible for any to be right but themselves, seem disposed to carry on their contentions longer than others will be willing to read them."

*Editor.*—No editor's name is formally attached to the work; but from the *tone* of the "Notices to the Public," and other *internal* evidence, we have arrived at the conclusion that Mr. J. Atkinson, the printer and publisher, was also the *general* editor of the work.

*Contents.*—The usual contents of each number are, Miscellaneous Pieces in Prose and Verse, Enigmas, Charades, Rebuses, Philosophical Queries and Mathematical Questions, Answers to Enigmas, &c.; together with a Calendar and a List of Fairs for each month. Most of the miscellaneous pieces are necessarily short, and though many of them possess considerable interest and no mean degree of merit, yet their *number* and variety preclude any thing like a particular enumeration. Suffice it to say that original essay, interesting extract, well-told anecdote, passable attempts at wit and humor, curious query, and instructive question, succeed each other in such variety as to form even at this distant period an agreeable *melange* to those oddities in human nature who prefer an *old* book before a *new* song, and who find more real pleasure in examining what *has been* than in discussing the day-dream reveries of the future. Each volume of the work is complete in itself; the editor and publisher "dis-

daining to take the advantage, which is commonly taken by the publishers of periodical works, *of running one volume into another.*" The *first* volume contains answers to 34, the *second* to 48, and the *third* to 40 queries on various subjects in natural philosophy, &c.; and each number of the last volume also contains "the description and history of some animal not generally known, or some interesting particulars of those which are more familiar to us." The philosophical department of the work appears to have been well sustained; the writers were evidently men who had a respectable acquaintance with natural and intellectual phenomena, and though most of them chose to adopt *fictitious* names, many of their short discussions possess more than a *temporary* interest. To whom these *fictitious* names belong, we have no means of ascertaining, though probably the *propria personæ* of nearly all such correspondents are well known to the editors of the publications to which they contribute. This may, therefore, be the proper place to suggest that each conductor of a periodical work would do good service to future inquirers were he to furnish, whenever practicable, a list of the adopted signatures in connection with the *real* names of those correspondents, who for temporary reasons have chosen to envelope themselves in the mist of obscurity. This has been *partially* done by Professor Leybourne in the index to his edition of the *Ladies' Diary*, but not to the extent he himself could have wished (Preface, p. 10), and the same thing has also been attempted, though perhaps in a less degree, in the general index to the *Gentleman's Mathematical Companion*, and in the second edition of the first volume of the *Cambridge Mathematical Journal*. We should feel much gratification did the preceding suggestion, *originally due to a distinguished friend*, possess sufficient interest so as to induce some one of the venerable contributors to such periodicals as the one under notice to draw up a paper or two on "*fictitious signatures*," and we have little doubt but that the editor of this journal will gladly allow the requisite space for such contributions.

*Questions.*— The total number of mathematical questions proposed and answered in this periodical is 113, of which 44 are contained in the *first*, 41 in the *second*, and 28 in the *third* volume. The subject to which they relate embrace most of the usual branches of pure and mixed mathematics, but those which require diagrams for their full comprehension are necessarily limited, "as the low price of the work would not allow of any expense on that account." Several of the contributors, however, adopt the expedient of *cutting or furnishing the necessary diagrams at their own expense*, and though the editor kindly informs them that they "may in general cut them themselves with a pen-knife, upon a piece of well-planed box wood, only observing to draw the figure upon the wood *reversed*, and to cut out the parts intended to be left blank, *sloping* to about one-eighth of an inch deep; but few of the contributors succeeded well in this branch of art.

The indifferent printing of the mathematical department precludes the possibility of forming a correct judgment of the merits of many of the solutions; the following enumeration, however, will show that the work contains some useful and interesting questions:—

Ques. 34, vol. I., by "Tommy Tangent," requires "the equation of the curve whose tangent is everywhere equal to a given quantity."

Ques. 35 inquires, "How many deals a person may play at the game of whist, without ever holding the same cards twice."

Ques. 4, vol. II., is another by "Tommy Tangent," and requires the "value of $x$ when log. $x$ is a minimum."

Ques. 9, by Mr. W. Ward, determines "universally the error in measuring the frustum of a cone, by the common method of reducing it to a cylinder."

Ques. 13, by "Howdonian," requires "that, of all cones having the same external surface, exclusive of the base, which will vibrate the quickest when suspended by the vertex."

Ques. 19 is the prize in the Number for May, 1794, and requires "two such fractions, the sum of whose squares shall be a square number; and, moreover, the product of the said fractions being subtracted from either of them, shall leave a perfect square."

Ques. 32, by Mr. Wm. Passman, requires "the dimensions of the greatest

cylinder that can be inscribed in a parabolic spindle."

Ques. 33 is the prize in the Number for August, 1794, and gives "the base and vertical angle of a plane triangle, to construct it so that the sum of the sides shall be a maximum."

Ques. 40 gives "the sum of the base and greater side, and the difference of the base and less side of a plane triangle, to determine the area or maximum."

Ques. 8, vol. III., determines "the greatest triangle that can be inscribed in a given circle."

Ques. 9, *bis*, supplies an algebraical demonstration to the property that, "in an equilateral triangle, the sum of the three perpendiculars let fall from any point upon the sides, will be equal to the perpendicular of the triangle." This property also formed Ques. 135 of "*Whiting's Delights*," and Ques. 1135 in the "*York Courant*," and has been frequently demonstrated elsewhere by various methods.

Ques. 18 was proposed by Mr. Wm. Passman, and relates to the *apparent* mechanical paradox that a beam of timber, in the form of a triangular prism, when fixed at one end with its base horizontal, becomes *stronger* when a small triangular prism from the top of the beam is cut away. Two solutions to the question were printed in the Number for August, 1795, the *first* by Mr. Passman, and the *second* "by Mr. W. Ward, pupil to Mr. Jackson," of Hutton Rugby School; but, as their results did not agree, the editor, "not to be accused of partiality," inserted *both*, and left his "readers to form a judgment therefrom."

A smart battle amongst the schoolmasters ensued, in which Messrs. Passman, Ward, Milner, Surtees, and Jackson took part. Mr. Ward charged Mr. Passman with copying Emerson's solution as his own; Mr. Passman retorted warmly, applying the epithet "*old grey contest gnat*" to his opponent's adviser, and, considering "his mathematical character at stake," battled manfully to maintain its integrity, in which he was well seconded by Messrs. Milner and Surtees. Messrs. Ward and Jackson, however, refused to be convinced, notwithstanding the authorities brought to bear against their positions; and after having "exhausted (the printer's) mathematical types," and probably the patience of many of his readers, the controversy "grew so fast and furious," that the "Bee" was discontinued, in order to allow the "controversialists an opportunity to forget their disputes, and sit down in *peace*, if not in friendship."

Ques. 21 gives "the base, the vertical angle (greater than a right one), and the ratio between the perpendicular and the difference of the segments of the base of a plane triangle to construct it." It was proposed by Mr. Gee, of Newcastle, and was answered by the proposer and Mr. J. T. McDonald, a name of frequent and respectable occurrence in the periodicals of the time.

*Contributors.* — Aristæus, Artuoso, Brigham, Buchanan, Bulmer, Cockrel, Gee, Glendinning (Neudangling), Horn, Jackson, Johnson, Kirkley, Lamb, Mc Donald, Milner, Nicholson, Passman, Peacock, Pearson, Rutherford, Simpson, Stodhart, Surtees, Tate, Todd, Tomlinson, Tom Paine, Tommy Tangent, Ward, Wilson, &c., &c.

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THOMAS WILKINSON.

Burnley, Lancashire, Jan. 8, 1850.

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ON THE STATE OF THE IRON MANUFACTURE IN THE UNITED STATES. BY MR. H. FAIRBAIRN.

At this time of depression in the iron manufacture of the United States, and the great improbability that the former high prices of iron will again be obtained, it seems to become a consideration for the American iron manufacturer how far there have been errors in the location of iron works, which may have been the cause of disadvantage in the competition with those British iron establishments which now undersell the native iron of Pennsylvania and the adjoining states; and how far the avoidance of these erroneous arrangements may yet contribute to the returning prosperity and the permanent profitable establishment of a great iron maufacturing interest in this quarter of the United States. Undoubtedly there lies open to the view of the geologist and the practical manufacturer, an immense future field for the making of iron in the regions in the vicinity of the Allegheny Mountains, amongst the coal fields of the State of Pennsylvania, where exist not the

some varieties of coal only, but the same iron ores and limestone as in the similar coal fields of Scotland, Staffordshire, and Wales. The carboniferous geology of Pennsylvania has become another confirmation of the great principle of Humboldt, that the general order of geology is the same all over the world.

But though there is every variety of coals in the interior of Pennsylvania as in the interior of the British lands, yet has there not been founded any one complete iron manufacturing establishment in the localities which answer to those of the establishments in Scotland and Wales. All the establishments in Pennsylvania are at a distance from the coal fields, and therefore under overwhelming disadvantages in the higher prices of coals, with other disadvantages in the disunited state of the processes of the manufacture, from the ore to the finished bars, rails, hoops, or sheets, all of which are made in the same locality in Great Britain, but nowhere in the United States. Yet on this concentration of the processes in the manufacture of iron all profit depends. It is in vain to compete with the iron manufacturers in Scotland or in Wales if more than one-half of the cost of the bar iron consists in the carriage of the coals and the pig iron through the State of Pennsylvania, all of which expense is saved to the iron manufacturer of Scotland or of Wales.

Thus a manufacturer of railroad iron in Wales, smelts his pig iron from the ore, puddles and refines the iron into bars, and mills the bars into railway iron, all with the coals dug at the door of his establishment, with the same steam engine throughout all the processes, by the same supervision, in a shorter period of time, with all the other advantages arising from the concentration of capital and labour in a manufacturing system established on an extensive scale. These are the advantages, and the only advantages, of the iron manufacturer in Wales, and this is the reason that railroad iron can be imported on cheaper terms into the city of Philadelphia than any which yet has been manufactured in the United States.

There are altogether about fourteen rolling mills in the United States, and these are almost all closed at the present time. Of these establishments two only, one on the Susquehanna and the other on the Schuylkill river, manufacture railway iron through all the stages from the iron ore to the finished rail; and these two establishments are at a distance so great from the coal fields, that all the coals are used at a cost of 3·50 dollars to 3·75 dollars per ton of anthracite coal, and, including the still higher prices of any semi-bituminous coal employed in the puddling furnaces, the price of the coals is fully 4 dollars per ton. These are the best and the only complete establishments in Pennsylvania, the other rolling mills being lower down the Schuylkill river, or in the city of Philadelphia, or they are even so far distant as in New Jersey or the Northern States. All of these rolling mills use pig iron manufactured at a distance, subject to the expenses of carriage and many other expenses between the iron furnace and the rolling mill, and the mills are all worked with anthracite coal, at an average cost of 4·25 dollars per ton, or, with semi-bituminous coals, usually at a cost of 6 dollars per ton, as imported from the Susquehanna river, or from Virginia, or Liverpool, or Nova Scotia, and everywhere at similarly excessive prices for this leading material of the trade.

Estimating the result of this difference in the cost of the coals, it will be found that, to manufacture a ton of railway iron from the pig metal, will require for the process of puddling, refining, milling, and steam-power, fully two tons of anthracite coal, or two and a half or three tons of semi-bituminous coals. The cost of these two tons of coals in Philadelphia, or at the average of the location of the existing rolling mills, will be not less than 9 dollars, or 5 dollars above the cost of the same coals at Pottsville or elsewhere in the coal fields of the interior of the State.

But were there erected a complete iron establishment at or near Pottsville or Pinegrove, or any other vicinity where coals are the cheapest rates, or about 2 dollars per ton, then the saving would be 5 dollars per ton in the coals required in the mere after processes of puddling and manufacturing the rails; but the previous savings would be more than double that amount on the coals which are required for the smelting of the iron from the ore, as compared to the least of the existing establishments, and the total difference would be 10 dollars on a ton of railway iron manufactured in Philadelphia, or at the other average locations of the rolling mills which do not manufacture the iron from the ore.

Thus it is seen that a ton of railway iron could be manufactured ten dollars cheaper in the coal region than in any place where iron has yet been manufactured in the United States. This is an immense difference, and one which would turn the scale entirely in favour of the American iron manufacturer; and therefore to the coal fields we must direct our attention, for the discovery of the only true localities where iron can be profitably and permanently manufactured in competition with Scotland and Wales.

The coal fields of Pennsylvania and of South Wales are the same in geological formation, anthracite coal degenerating into semi-bituminous coals, and the silicious carbonates of iron interlying everywhere the seams of coals. There is the same inexhaustible quantity of carbonate of iron in Pennsylvania, the same mountain limestone intervenes in the coal measures, and all the minerals are the same in the carboniferous regions of the Old and the New World. The anthracite iron furnaces in Wales are in the vicinity of Swansea, which answers to Pottsville, and the main body of the furnaces are at Merther Twydwell, which is on the semi-bituminous coal formation, and answers to the country about Pinegrove and further towards the west. The iron ores have been found by Mr. Cowling Taylor and other eminent surveyors, to be precisely the same in the coal regions of Pennsylvania and of Wales.

Whilst the main considerations are thus the same in both countries, there are other advantages which seem to be greatly in favour of Pennsylvania, and amongst these is the greater accessibility to the superior iron ores in Pennsylvania than in Wales; for it is to be borne in mind that all the iron manufactured at this time in Wales is of an inferior description, in consequence of the inferiority of the ores, and this disadvantage applies also to the one or two iron furnaces which have yet been erected in the Pennsylvanian region of coals. From hard silicious iron ore only a tough, unmalleable, and cold short iron can be made, and the richer hermatite ores are indispensable for admixture with the silicious ores of Pottsville or of Wales. But in Wales these hematite ores can only be obtained from the north of England, and their expense is so great that this circumstance now threatens the most serious consequences to the trade of Wales. A ton of hematite ore cannot be brought from Ulverston to Merther Twydwell at a cost of less than 28*s*. per ton, and yet so important is it to have hematite for admixture with the native ores, that the character of the Welsh railroad iron is rapidly degenerating in foreign markets, by reason of the impossibility of affording the importation of these ores at the prices for railroad iron which can only now be obtained, in consequence of the low prices established on the Clyde. One eminent firm at Merther Twydwell formerly imported 6,000 tons of hematite ore from Lancashire, and this was the cause of the high character of the iron made by that company; but it is certain that this expensive ore can no longer be obtained when the contract prices of cargo iron have fallen to the present ruinous rates in Wales. Thus it is that the Welsh railway iron is losing its reputation in the markets of the United States; for the absence of the former quantity of hematite ore in the iron causes the rails to be cold short in quality; they are consequently brittle, and become fractured, laminated, and worn out in a comparatively very short time, being considered to be eight or ten dollars less valuable than the rails which can be supplied from the rail-mills of the United States.

On the other hand, the hematite ores could be obtained at less than one-half of the expense at Pottsville or at Pinegrove, as at Swansea or any other place in Wales. The hematite, or hepatite, or other rich iron ores, are in boundless profusion in the hills at various distances from the coal regions of Pennsylvania; but taking the average distance at fifty miles, the cost would be only about two dollars per ton above the iron ores raised on the spot. About one-quarter of the ore, as hematite, is the best mixture for railway iron, or in various other proportions for all varieties of bar iron; and we therefore see a very important advantage to Pennsylvania in the greater proximity, accessibility, and cheapness of the hematite ores as compared to Wales.

Having in this manner the certainty of the same carbonates of iron, the same limestone, and the same coals, with also the certainty of the superior ores at still cheaper rates, let it now be our inquiry how far there are other advantages or disadvantages respectively in Pennsylvania or in Wales.

When the improvident location of the iron furnaces may be overcome in the future iron manufacture of Pennsylvania, there will be comparatively few remaining advantages to the iron manufacturer of Wales; for the expenses of labour, though formerly very much higher in Pennsylvania, can no longer be said to be excessively different, as in Great Britain; for the vast influx of emigrants, skilled and unskilled, who are arriving from Europe, have already brought down the rates of labour very considerably below the rates of some few years since. There is found to be little real difference in the cost of mining coals, iron ore, or limestone, at Pottsville or at Merther Twydwell, the better levels in Pennsylvania saving much of steam power and expense for higher wages of miners; and respecting the labour about the furnace, this, in Great Britain, enters at the average rate of 4s. into the ton of iron, and allowing the difference to be 50 per cent. greater in Pennsylvania, this will be less than half a dollar per ton higher in Pennsylvania than in Wales. There have always been very exaggerated opinions respecting the difference in the cost of the

labour in the iron manufacture in Great Britain and in the United States.

On the other hand, the higher prices of labour are far outweighed by the lower rental of mineral lands in the United States. In Wales or in Scotland, the royalties or rental of minerals enter into the cost of a ton of bar iron at the rate of 10s. to 14s. sterling, or about 25 per cent. upon the whole cost of the iron; but in Pennsylvania, the rent of the coals, iron ore, and limestone, would not be more than one-half of the same sum per ton of iron, since the coal fields are so extensive, and all property is so much lower in value than in Great Britain, that ages must pass over before any important rise can be anticipated in the value of coals and of mineral lands in the United States. Respecting the relative value of capital and interest of money, there is also a continually less advantage in favor of the British manufacturer, for the value of money is daily becoming more equalized, by reason of the favorable balance of general trade which has been established since the Repeal of the Corn Laws of England, and the consequent large payments for the bread stuffs of the United States. Some advantage still remains to the British manufacturer, but the amount of the difference on the annual interest of money invested in iron works in Pennsylvania, or in Wales or Scotland, would be found to be an unimportant consideration where there was otherwise a well-located and well-conducted iron establishment in the coal regions of the United States.

There would thus be many and great advantages in changing the location of iron works, and in the concentration of the various processes, from the iron ore to the finished bars or railway iron, which cannot now be made in competition with the iron brought over the Atlantic Ocean, and from places not even so well situated for the manufacture as are the coal regions of the United States.

If the iron manufacturer in Wales, or in Scotland, were to smelt his iron with coals brought from Newcastle-upon-Tyne, and costing 28*s*. per ton, and were to bring his pig iron from Staffordshire, he would be only doing that which is daily seen in Pennsylvania, in the use of Liverpool or Sydney coal, and of Scotch pig iron, in the rolling mills of the Schuylkill river, and he consequently would cease to be able to compete for the supply of iron to the markets of the United States. The carriage of coals for even a few miles has been found to amount to an annual expense which has been fatal to some branches of manufacture in Great Britain, and this consideration is all-important with those who are aiming at the restoration and permanent foundation of the great iron business which Nature so evidently has intended to exist in the Allegheny regions of the United States.

Only the finer branches of iron manufacture can exist in cities, or in localities distant from the supplies of coal. In Liverpool there are large foundries, and a great steam engine-building business is carried on, but the heavier parts of the engines are brought from places in the Midland Counties, and only the finer parts of the work are manufactured in Liverpool; whilst in London, though myriads of people are employed in manufactures of which iron is the raw material, yet it is in cutlery, in fine castings, and the thousand divisions of business in which the raw material does not enter so largely into the manufactured articles as does the skill of the artizan, the presence of the metropolitan market, the fashion, foreign demand, and many other considerations which favor manufacturers in cities and towns. But a bar of railway iron was never made in Liverpool or in London, and none can be profitably made in Philadelphia, which is the Liverpool of the United States. Founderies, cutleries, and all other skilled iron manufactures of endless varieties, might be established with the greatest advantage in Philadelphia; but the pig iron, the bar iron, railway bars, beams for steam engines, and all other heavy and comparatively cheap iron and iron manufactures, only can be furnished from the places where fuel is to be obtained at the lowest rates.

These considerations are now of compulsory importance in the iron interests of Pennsylvania, as it is vain to live in hope of the return of these high prices of iron which rendered the manufacture of bars profitable in almost any situation, or at any price for coals. The iron manufacture of Scotland is extending against all the adverse circumstances of Great Britain, at this time of commercial depression through the world, and bar iron is becoming amongst the foreign exports of the Clyde. There are advantages in Scotland superior to those of Staffordshire or of Wales, for the hematite ores of Lancashire and Cumberland are almost close at hand for importation to the Clyde, and the position of the iron works at Glasgow is nearer to the Western coast of England, and to the United States and the general foreign markets, and there are, therefore, reasons for apprehending the total destruction of the great iron manufacture of South Wales, and the permanent establishment of low prices of iron through the world.

But when we see that, in Pennsylvania, there are all the grand advantages existing

equally as in Scotland, in the coal fields, the iron ores, the limestone—all at lower rates of rental and equal rates of mining; labour not materially higher, and capital not materially more valuable; with every prospect that the advantage will continue to grow greater to the iron manufacturer of Pennsylvania, in both capital and labor; that there is now, and always may be expected to remain, a Custom-house duty of 30 per cent., or some other important sum, against the foreign iron manufacturer, with the freight and charges across the Atlantic Ocean, and other advantages, it cannot be doubted that the iron manufacture can be established on the most solid permanent foundation on the coal fields of the Central State of the United States. — *Franklin Journal.*

## GOSSIP ON GOLOSHES, PONCHOS, RAZORS, ETC.

"De rebus cunctis, et quibusdam aliis."

Sir,—Having recently migrated into a region almost beyond the bounds of civilization, I have all at once found the need of several things, which were useless whilst I had the parks to walk in, and omnibuses and cabs within hail every minute. Before I can get even to the infinitely small village where the nearest human beings live, I have to wade through quagmires, or else over ice, according as the weather may be. In these circumstances I have found the India rubber goloshes invaluable, especially those with *roughened* soles to prevent slipping. But it has occurred to me that even they may be improved. And what I suggest, in the first place, is, that the soles might be made in the same way as the covers for wheel tyres have been made of the same material—namely, as air-tight *cases*, containing a thin layer or stratum of air. The advantage of this would be, that they would yield to the inequalities of the road, and thus wear much longer. And over such roads as I have around me here—which when a frost has hardened them, are as bad as any ploughed field could be in a similar frozen state—the increased comfort and ease in walking, can only be imagined by those who have experienced the annoyance of having no firm hold for the foot for miles together in such circumstances. I think I remember seeing in your Magazine, some time since, the result of some experiment with such air-tight cases for carriage-wheels; and that they were found after some months' work over rough roads, to be almost as fresh and sound as at first. I hope that some one, if not those already engaged in the manufacture of goloshes, will take up the matter and produce, at a reasonable price, such an article as I have described. There can be no doubt of its answering as a mercantile speculation.

Another more recent invention which I have found extremely convenient and comfortable, is the garment called a *Poncho*—and although it has been introduced for upwards of two years, its merits cannot be so well known as they ought to be, or we should see them much more frequently. Here in the north, *plaids* are all the fashion; but, with all due respect to our north country friends, who are, indeed, generally "wise enough in their own generation," these plaids are simple absurdities. They look *picturesque* and *clannish;* but that is all that can be said in their favour. They can never be made, fold them how you will, to cover the whole, or even any but a small portion of the body. Now the *poncho* is a complete *envelope*, and may also be folded or held in a thousand different ways, according as protection may be wanted in one part more than another. The material, too, has all the comfortable, warm, snug *feel* that is perceived in the glossy coat of that most cosy of materials—the cat. The long silky wool has the advantage, too, of throwing off the wet to a considerable extent instead of retaining it. Then, again, as a minor consideration, you may carry things under its folds, completely *incog.*—a hint that will be appreciated by those gentlemen who are nervously sensitive to any infringement of their dignity, and yet would often be glad to become their own porters. Dr. Buckland is said to carry about occasionally *legs of mutton* in a blue bag, usually imagined by the unlearned to contain sundry profound geological specimens and instruments. And so you may do under the impenetrable veil of the poncho; and that, too, without the risk of discovery arising from any unlucky opening of the said garment; a ludicrous example of which kind of unlucky exposure once occurred to a man of the same college as myself at Cambridge, after the following fashion.—It is not allowed at some colleges to have anything brought into the college from the cooks or confectioners of the town on Sunday mornings. Now, Sunday is the grand day for breakfast parties, there being no lectures to interrupt proceedings. Well, then, to import such necessaries unobserved, it is a common artifice to go out yourself into the town with the surplice on and bring back the needful under cover thereof. This accordingly the student in question adopted, and was bringing in a monstrous pigeon-pie just as all the "Dons," and others, were marching in solemn array into the college chapel; our friend looked as solemn and

devout as any of them with his surplice on. But all of a sudden comes a violent puff of wind! Surplice blows open—and to the astonishment of the Reverend Seniors, the pie stands forth in all its native attractions to the public gaze.—Such a catastrophe cannot happen to the wearer of the poncho.

Further: — but if I go on this way, your readers will set me down forthwith as being bribed on purpose to puff this poncho. I wish I were! My inclination and my interest would then exactly coincide. Considering, indeed, the very handsome eulogiums I have pronounced on this said poncho, it would not be, perhaps, altogether unreasonable if I *were* to hint that the proprietors or patentees cannot do less than forward a couple—one to you as Editor, and the other to me, "as a slight token of their grateful esteem for such unsolicited patronage!"

Another very desirable article amongst the recent patents, is Stewart's guard-razor [or "The Plantagenet Razor," as the patentee chooses to call it; *why*, it is not easy to guess—unless the *Stewarts* have still a brotherly affection for the royal house of Plantagenet. But, certes, *Tudor*, or Tutor, *i.e.* protector, razor would have been more appropriate]. To most of your readers this razor will be already known, at least per advertisement; and it has already been most highly praised by most of the papers. But it is really so seldom now-a-days that even respectable people and newspapers ever think of telling the truth in their advertisements, that when one finds something that is really not a downright unmitigated lie, it is a duty to human nature to chronicle the event. Such is the case, then, with the "Plantagenet Guard Razor." It is really and truly everything it professes and other people have professed of it. With it anybody can shave himself, or anybody else—at all times—in all places—seasonable and unseasonable—light or pitch dark—still in his bedroom or in a rolling ship—*without any possibility of cutting himself* (unless there be pimples, &c.) In one of these dark winter's mornings, when a light is not to be had, or even when it is, this razor is a blessing; for you need no looking-glass, you may shave just as well with your eyes *shut* as with them open. I have used one now constantly since last June, and can therefore speak from actual trial. To those unfortunate gentlemen who are always cutting themselves, and otherwise smarters under an ill-executed operation, this razor will be literally worth any money.

Connected also with my present outlandish position, is a remark I wish to make on railways. Will you be good enough to hint to the worshipful directors of railways, and especially of the Newcastle and Berwick Line, that they would lose nothing by a little more attention to the wishes and accommodation of the public. By granting return tickets more freely and unrestrictedly, the present absurd regulations as to what trains you may go by, and what not—and by a revision of their fares—they would get more than enough additional traffic to repay the step. I, for one, should often go to the nearest market-town, and to Newcastle, &c., whereas now the object is to go as seldom as possible. I am, Sir, yours, &c.,

A. H.

## USHER'S PATENT STEAM PLOUGH.

[Patent dated July 18, 1849. Patentee, James Usher, Edinburgh. Specification enrolled, Jan. 10, 1850.]

This invention consists; firstly, in mounting a series of ploughs in the same plane around an axis, so that the ploughs shall successively come into action; and secondly, in applying power to give rotary motion to a series of ploughs or other instruments for tilling the earth, so that the resistance of the earth to the ploughs or instruments, as they enter and travel through the earth, shall cause the machine to be propelled.

Fig. 1 shows a side elevation of steam machinery arranged suitably for carrying out this invention; fig. 2 is a plan thereof, the steam boiler and engine being removed. Fig. 3 is a plan of a plough when two mould boards are used, in cases where it is desired to turn the land on either side; and fig. 4 shows a side view of one of the ploughs on its axis, by which and by fig. 1 it will be seen that the under edge of the mould board and share is formed to a curve struck from the centre of the shaft or axis on which the ploughs are affixed; *a a* indicate the bed-frame or carriage of the machine. The fore carriage wheels *b b* are mounted on an axle, which turns in bearings *c* attached to the swivel frame D, which moves on the bolts *d* for the purpose of causing the machine to turn round in a small space. A portion of the swivel frame D is toothed, and acted upon by the pinion and winch *e*; the hind-part of the carriage is here shown supported upon the hollow cylinder or roller

*f*, composed of two extreme parts, $f^1$ and $f^2$, which are wheels similar to *b b*, the intermediate part *f* being by preference removable at pleasure, so as to render these bearing parts suitable to the different stages of cultivation to which the machine may be applied. This compound cylinder has its axle supported in the bearings *g* attached to the lower, or to the under side of the carriage frame. The axle of this cylinder carries also at one end the wheel *h*, to be afterwards noticed.

Fig. 1. Fig. 4.

Fig. 2.

A movable lever frame *i*, *i*, *i*, *i*, is supported on an axle or shaft *k*, as a fulcrum. The free ends $i'$ $i'$ are formed into the toothed segments *e*, and are concentric to *k*, these segments being acted upon by the two toothed pinions and spindles *m*, which elevates or depresses the hind part *i i* of the lever frame, and all that it carries, at the pleasure of the conductor.

On the carriage thus constructed is placed the locomotive boiler, with its engines of any ordinary construction, as *n n*, the power of which is applied through the medium of connecting rods *o* to the crank shaft *p*, the two arms of which stand at right angles to each other, in the usual way. The crank shaft *p* is supported on two standards *q* securely fixed to the carriage. On the shaft *p* there is also fixed the spur pinion, indicated by the dotted circle *p' p'* in fig. 1; and this pinion, by taking into the wheel *r*, mounted on the shaft *k*, gives motion at the same time to the pinion *t*, which is carried round on the same shaft *k*. The pinion *t*, thus actuated, takes into the wheel *h*, before referred to, on the bearing cylinder *f*; and it is preferred tha the pinion *t* should be applied so as readily to be put into and out of gear with its wheel, though not so shown in the engraving. By this arrangement of parts, a slow progressive motion is obtained for the whole machine, on the one hand through the cylinder *f*, and on the other hand a separate rotary motion, at a certain increase of speed, is communicated through the wheel *r* to the pinion *w*, fixed upon the pinion *u u*, which last-named shaft has its bearings *v v* attached to the movable frame *i i*.

On the shaft *u u* are placed a series of plates or projections, fixed at regular distances. Or such plates or projections, with their ploughs afterwards described, may be placed upon separate shafts, each with its own proper gearing; but it is preferred to place them on one shaft. These plates or projections on the axis are shaped in such manner as to receive and have affixed to each of them several ploughs, adapted by their revolving motion to penetrate the soil, and by their mould boards to elevate and turn over portions thereof; *a a* are the plates or projections fixed upon the shaft *v*; they are each formed with a strong boss at the centre, by which it may be securely fixed to the shaft. Each plate *a'* has three arms or prolongations *b*, *b*, *b*, which terminate in the radial direction shown; a further prolongation *d' d'* is carried obliquely upon each of these arms. Upon the plate and projections thus constructed is affixed the tilling apparatus, which consists, firstly, of the part *e'*, which acts the part of the mould board or turn-furrow in the common plough; and it is to be fixed by screw bolts or otherwise to the prolongations *d' d'*. To the fore part of this mould board *e e* is affixed a bar *f* of wrought iron, which is also furnished with a lug *f''*, by which it is attached to the plate, by means of screw bolts or otherwise; the bar *f*, thus secured, forms a head or share bearer, as in many common ploughs. To the fore part of the bar *f* the share *g* is adapted, and fixed by its socket. The mould board, and also the share, may be varied in form. A fore-cutter, or coulter *h'* is affixed in front of each share, by screw bolts or otherwise, and is provided with the means of adjustment through the counter slits, in itself, and in the plate; but, in order to meet the different qualities of soils and the various stages of tillage, the further provisions shown in figs. 3 and 4 are employed. Fig. 4 shows a variation in the form of the plate *a* of figs. 1 and 2. *u* is the shaft, as before, carrying the plates or projections; $a^1$ shows a detached portion of one of these plates, in which the curved part $a^2$ to $a^3$ is brought forward and armed with a steel blade, answering the purpose of the separate coulter *h'* in fig. 1; *e* is the mould board, and *g'* the share, as before. Fig. 3 is a form of plough suitable to the tillage of green crops; *a'* is a portion of the plate or projection, seen edgeways; *e'* and *e'* are right and left mould boards, and *g'* a plain spear-shaped share. The number of plates or projections, and also the number of ploughs in each, may be varied.

It will be seen, that not only the ploughs which are set in the same plane around the axis follow each other into action, but that the ploughs of the other sets (which are affixed around the axis in parallel planes) are arranged and come into action, so that two ploughshares will not strike the earth at the same instant. In the arrangement of the apparatus before described, it will be seen that the propelling of the machine along the land is by reason of the resistance of the land to the ploughs as they enter and travel through the earth, and the motion communicated to the wheels or rollers. This part of the invention is applicable where teeth or tines suitable for tilling the earth are applied about an axis, and will be found to act better than machines in which tines or teeth set around an axis, have had motion communicated to them from the wheels which run on the land. In thus using this part of the invention, the only change necessary will be to employ a rotary axis *u*, having tines or teeth of any suitable shape, in place of the ploughs shown in the engravings.

INSTITUTION OF CIVIL ENGINEERS. THE NEW PRESIDENT'S ADDRESS.

(Concluded from page 58.)

The harbour at Holyhead, and the new docks at Leith and Grimsby, also by Mr. Rendel, do equal credit to his comprehensive designs and his executive skill. In conjunction with these maritime works may be mentioned two lighthouses, both possessing remarkable features. The first is an iron structure, erected on the Bishop's Rock, by Mr. Walker. It is situated about thirty miles from the Land's-end, Cornwall, and four miles due west from the St. Agnes' Lighthouse, which would probably not have been constructed had our ancestors possessed the modern facilities for the execution of works of this nature. The position is more exposed to the force of the Atlantic than the famed Eddystone Lighthouse, and the surface of the rock is of such an outline as scarcely to admit of a solid building. It was therefore determined to erect such a structure as should offer little or no opposition to the waves, and bear a light at such an elevation as to render it extensively useful. Six hollow cast-iron columns, with a strong bar of wrought iron in each, sunk to the depth of 5 feet into the rock, forming at the base a hexagon 30 feet in diameter, and tapering upwards, support, at a height of about 100 feet, the dwelling of the three light-keepers, with stores and provisions for four months, the whole being surmounted by the lantern. The access to the dwelling is by a centre column of cast iron, containing a spiral staircase. The difficulties overcome in the execution of this bold design can scarcely be appreciated without a more detailed account of it, which however, I trust, will be laid before you during this session. The other is a stone lighthouse, called the Skerryvore, erected by Mr. Alan Stevenson, on a small desolate rock situated about 11 miles W.S.W. of the island of Tyree, and 50 miles from the mainland of Scotland. The rock is exposed to the full fury of the North Atlantic, and is surrounded by an almost perpetual surf. The talent and perseverance of the engineer enabled him, however, to complete, without loss of life or limb—great as were the difficulties he had to contend with—a structure far exceeding the dimensions of the famed Eddystone and Bell-rock Lighthouses, their relative heights being—

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|---|---|
| The Eddystone .... | 68 feet. |
| The Bell Rock .... | 100 feet. |
| The Skerryvore .. | 130 feet 6 inches. |

The difficulties of the construction, the merits of the structure, and the system of lighting, are so fully described in Mr. Stevenson's published account of it, that it is not necessary for me to do more than to point to it, as one of the remarkable works of the present day, of which we have justly reason to be proud. In steam navigation, great efforts have been made by some of the principal marine engineers and the builders of wood and iron vessels. The result has been the production of four steamers, with engines by Messrs. Seaward and Miller, Penn, and Forrester, in vessels built respectively by Messrs. Mare, Miller, Thompson, and Laird, for conveying the mails; and an equal number of engines by Messrs. Maudslay and Field, Forrester, and Bury, in vessels by Messrs. Wigram, Mare, Laird, and Vernon, for carrying passengers between Holyhead and Dublin, which have attained the speed of nearly 18 miles per hour, and accomplish the passage on an average, in four hours. By these means, when the Britannia tubular bridge is completed, the journey between London and Dublin may be accomplished within eleven hours. This is an extraordinary advance upon the opinions of only a few years since, when it was reported to be possible to perform the same distance in fourteen hours. The excellent machinery of Messrs. Maudslay and Field, and of Messrs. Forrester and Co., in the iron steamers built by Mr. C. Mare and Mr. J. Laird, have also contributed mainly in accomplishing a journey to Paris, as we have recently seen it performed, in eight hours and a half; giving a death-blow to the onerous system of passports, which hitherto interfered so materially with that free and unrestricted communication so essential for the mutual benefit of the two countries. In the accomplishment of this rapid communication, with Paris, I may be permitted to feel some pride, as, in my capacity of engineer of the South-Eastern, and in my professional connection with the Boulogne and Amiens Railways, the possibility of expediting the intercourse between the two capitals, constantly occupied my mind; and so long ago as in June, 1843, before the present fast steam-boats were placed on the station, I undertook and accomplished the task of conveying the Directors and their friends from London to Boulogne, and home again, between six o'clock in the morning and ten o'clock in the evening, with a sufficient interval for a public reception at Boulogne. Among the builders of steam-vessels, Mr. Scott Russell must be particularly mentioned, for the successful investigation and application of the wave lines to the forms of vessels, so that the curves of least disturbance can at once be adapted to a vessel, the

ultimate, or greatest velocity of which has been previously determined; and thus high speeds, and easy motion through the water, can be attained; whilst a given immersion is arrived at with certainty. These points were remarkably shown in the *Manchester*, a vessel for carrying passengers across the Humber, at New Holland, and with its consort steamer the *Sheffield*, constructed by Messrs. Rennie, becoming, as it were, floating bridges, completing the line of the Manchester, Sheffield, and Lincolnshire Railway, and conveying the contents of the trains, from point to point, at a speed of about sixteen miles an hour. In connection with this railway must be mentioned, the large pontoon, recently built by Messrs. E. B. Wilson and Co., of Leeds, from the design and under the direction of Mr. John Fowler. This immense iron vessel, which is 400 feet long, 50 ft. wide, and 8 feet deep, with a deck area of 20,000 square feet, serves as a floating landing stage for these fast passage-steamers, rendering the railway trains independent of the tide and of the muddy shores of the Humber. The deck-area of this landing stage is about half that of a somewhat similar structure built a short time previous from my designs, and under my direction, at Liverpool, and of which a description and drawings will be prepared for an early meeting of the Institution; as an earnest of my intention to practice what I have ventured to impress upon all those, who not only possess the information, but the power of imparting it, for the benefit of their professional brethren. A number of fine steamers have also been constructed for the Government, for private companies, and for foreign States, in which the beautiful engines of Maudslay and Field, Miller, Seaward, Penn, Napier, Rennie, and others, have fully maintained their European reputation. This incomplete sketch of a few of the engineering works of the past year, leaves untouched that vast subject, the railway system, towards the completion of which much has been accomplished within the last twelve months, without that public excitement which accompanied all its former progress. There are now nearly 5,500 miles of railway completed in Great Britain, at a cost of about 220,000,000*l.* sterling; which immense sum, derived from private sources, has been expended within the realm, encouraging in an extraordinary degree productive industry of all kinds, and inducing a revolution in all mercantile transactions and social relations. The steam-engine and the power-loom have been regarded by the soberminded political economist as the real sources of the power and influence of Great Britain, and though the gallantry of her hardy sons, both in the military and the naval services may have been more publicly apparent, and were in fact, inestimably valuable when called into action, it is the productive classes of this country that constitute its real strength. The example of England, in boldly abandoning the finest roads, and adopting throughout the length and breadth of the land, a net work of iron ways, over which, by the aid of steam, passengers and merchandize are conveyed at a velocity, which, at its first proposition, was by the world deemed worse than visionary, first filled our continental neighbours with astonishment, and then compelled their imitation, so that within a few years, by this new power, the relative positions of the continental states are changed, and the ultimate effect must be to introduce wants, and consequently civilization, to the most remote corners of the world.

## MESSRS. JOYCE AND CO.'S PENDULOUS STEAM ENGINES.

On Saturday last we had the pleasure of inspecting a steam flour-mill, which has recently been constructed by Messrs. Joyce and Co., of Greenwich Iron Works, for the Smyrna Steam Flour-mill Company's Works at Smyrna. The mill-work, which is of Messrs. Joyce's improved construction, with a cast-iron frame and bevel gear, is, to quote the engineer's (Mr. E. Galloway) report—"simple, tasteful, and effective, and the details amply sufficient for grinding and dressing." It will, when completed, work 14 pairs of stones, capable of grinding 1,000 quarters of grain a week, and is driven by a pair of Joyce's pendulous engines, of 50 horses power nominally, but really of 90 horses power, and capable of being raised to upwards of 100 horses power by a small increase of steam pressure beyond what it is proposed to work at generally. With a view to such increase of pressure, the boilers have been constructed of greater strength and capacity than would ordinarily be required, so much so that it was estimated by the engineers present that one boiler would generate nearly sufficient steam for supplying the two engines, which might safely be worked at double the maximum degree of pressure. The engines, as indicated by their name, have their cylinders suspended by hollow trunnions at top, for admitting steam, and are worked on Wolf's principle, of using steam both at high pressure and expansively. They, moreover, are made to communicate the power direct to the driving shaft, without the intervention of connecting gear, which, in combination with the small number of working parts, and the simplicity of several details of construction,

recently patented, cannot (according to the report quoted before) fail to ensure their working economically as regards the consumption of fuel (under 3 lbs. of coals per horse power an hour), and with a great reduction of wear and tear.

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SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 24, 1850.

JOHN HOLLAND, Larkhall Rise, Clapham, gentleman. *For a new mode of making steel.* (A communication.) Patent dated July 18, 1849.

Mr. Holland proposes to convert wrought iron articles into steel by exposing them in a furnace to the action of alternate layers of carbonized and uncarbonized materials; the latter consisting of silk-worms, silk cocoons, silk waste, &c., which the patentee torrefies, or highly dries, without carbonization, then reduces to powder, and stores it in air-tight vessels until required for use. When, for instance, it is desired to convert the top surface of rails or ploughshares to the depth of half an inch, the patentee spreads over the surface of an oven or furnace a layer, of an inch deep, of coal-dust, coal-slack, or coke-powder, or of a mixture of these substances, and above that a layer, of equal depth, of the torrefied substance, upon which the iron articles are placed, with their surfaces to be steeled in contact with the torrefied substance, care being taken to cover such portions as are not to be steeled with clay. The furnace is filled with a series of layers of these different materials, and heated to the ordinary temperature until the conversion is effected, which will be in a much shorter time than has hitherto been practicable, and may be ascertained by testing in the usual way.

To convert iron ore into steel, it is first reduced to pieces of the size of a nut, walnut, or egg, and then well washed to free it from dirt, and subsequently enveloped in a paste composed of equal parts of clay and slack lime mixed with water, and subjected to heat, after which it is submitted to the above cementing process in crucibles or close vessels.

*Claim.*—The application of silk-worm chrysallides, cocoons, the silkworm and its products, and the refuse of the same, to the manufacture of steel.

THOMAS WALKER, Birmingham, stove manufacturer. *For improvements in boots and shoes, and in the manufacture of parts of boots, shoes, clogs, and goloshes.* Patent dated July 18, 1850.

This invention consists in constructing the revolving heels of boots, &c., in any of the following modes:—

1. A metal ring, having an inside shoulder at bottom, which contains a revolving leather disc, and an external flange at top fitted with an outer collar, which is attached to the heel part of the sole, and thereby retains the ring in position, without at all interfering with the free action of the disc to which the heel itself is made fast, so that the two may be caused to rotate at pleasure.

2. A metal ring is used to form the external part of the heel, and is retained in position by a central disc of leather (connected to the sole), which at the same time allows it to revolve.

3. Instead of the metal ring being constructed as in the first instance, it may be made with the side to incline inwards, so as to form a kind of hollow cone, and it is retained in position by means of a central disc of leather made fast to the sole, while the heel is attached to a collar of leather previously slipped over the cone, and is consequently free to revolve.

The patentee describes some modifications of the preceding arrangements, and states that gutta percha may be used instead of leather.

4. It is proposed to manufacture the metallic rings by first stamping them out of sheet metal, and then subjecting them to the action of suitably-formed dies to give them the required shape.

*Claims.*—1. The mode of manufacturing the heels of boots and shoes, whereby the central disc and heel may be allowed to revolve together.

2. The mode of manufacturing the heels of boots and shoes whereby the exterior metal ring may be allowed to rotate.

3. The combining a conical metal ring with other parts to produce a revolving heel.

4. Stamping the rings employed in the manufacture of revolving heels for boots, shoes, clogs, and goloshes.

ANDREW PEDDIE HOW, of the United States, now residing in Basinghall-street, engineer. *For an instrument or instruments for ascertaining the saltness of water in steam boilers.* Patent dated July 18, 1849.

This invention consists of an instrument, termed by the patentee a "salinometer," by the use of which, and the mere inspection of the indications which it affords, the exact degree of density, and consequently of saltness, possessed by the water in the boilers of marine steam engines, can be ascertained at all times and under all circumstances, independently of the pressure in the boiler, and the engineer be thereby enabled to deter-

mine when the water has attained to such a degree of saturation as to render freshening necessary, in order to prevent deposition of salt from taking place. This instrument consists of a vertical cylinder communicating at bottom with the lower and upper strata of the water in the boiler, by means of two passages, and containing a floating hydrometer, which carries a graduated stalk. The cylinder is provided with an overflow and waste pipe and a thermometer.

When the boilers are at work, one only of the passages is kept open at a time. The consequence is, that the cylinder is first filled to the height of the mouth of the overflow pipe, and that then a continuous inflow takes place on the one hand from the boiler, and a continuous outflow through the waste pipe on the other; that is to say, there is a constant flow of water through the salinometer, of the same density precisely as the water in that part of the boiler from which the supply is derived, and which density is shown on the graduated stalk of the hydrometer. A thermometer is combined with this instrument, because the density or saltness of the water varies with the degree of temperature, and it is necessary to correct the indications of the hydrometer by those of the thermometer, as often as the hydrometer rises or falls beyond the standard point to which it may have been graduated.

*Claim.*—The peculiar arrangement, combination, and adaptation of means (each by itself well known) embodied in the single instrument before described, whereby the marine steam engineer is enabled, by the mere inspection of the said instrument, to ascertain, at all times and under all circumstances, the density of the water in the boiler, independently of the pressure within the boiler.

EVAN LEIGH, Ashton-under-Lyne, cotton-spinner. *For certain improvements in communicating steam or other power for driving machinery.* Patent dated July 18, 1849.

In the drawings which accompany Mr. Leigh's specification, his improvements are represented as applied to oscillating steam engines, in the following manner:—The framework is keyed, or otherwise securely attached to two foundation chambers, connected together by a central pipe, which form the condenser. The cylinders, which are four in number, are connected in pairs by their respective rods—the rod of the one passing through a fork in the rod of the same pair—to two cranks on the same shaft. These cranks are placed at an obtuse angle of 135°, in order that the shaft may receive a fresh impulse at every quarter of a revolution. The cylinders, instead of being supported on hollow trunnions, which admit steam to their interiors, are supported on centres passing through suitable stuffing-boxes, in bosses cast or fixed to the frame. One of the bosses for each cylinder is made hollow, and communicates, by a chamber and passage in the frame, with a pipe leading from the boiler. At the other end of the boss there is a pipe, which is bent round and connected to a steam chamber attached to the cylinder, which contains the slide and expansion valves for regulating the admission of steam thereto. The steam, when exhausted, escapes through apertures into a chamber formed by a jacket, which envelopes a portion of the cylinder, whence it passes, by a flexible pipe, to the condenser or atmosphere. The slides are made with ledges, which cover the ports, and to which the valve-rod is made fast, so that they may be always in view, instead of being hidden as is at present usual. The expansion valve is worked by an eccentric, independently of the one which works the slide valve. The slide valve eccentric is keyed on the crank of the shaft, and carries at the other end a ring, with internal teeth, while its boss carries loosely the eccentric of the expansion valve, which is also furnished with a ring having internal teeth. Between the two rings is placed a spur wheel, which carries, above and beneath the crank, two pairs of pinions keyed on the ends of two spindles, free to revolve therein. The pinions of each pair gear into the internally toothed rings of the fast and loose eccentrics, so that the rotary movement of the former is imparted to the latter, and, by means of their respective connecting rods, to the slide and expansion valves, which are thus made to act uniformly, and the thoroughfare entirely opened at the commencement of the stroke. That is, supposing always that the spur wheel is free to revolve with the rest. But when it is held fast by the following arrangement, the relative positions of the eccentrics will be altered, and the steam cut off at a different portion of the stroke. The spur wheel at top takes into a worm fixed on a horizontal shaft, one end of which is fitted with a friction roller, and rests thereby upon a flat surface in connection with the steam governor. The cylinder lid and gland above it are made hollow, to contain oil for lubricating the piston and piston rod. The air pump is worked by a connecting rod from the crank, and fitted with slide valves, which are arranged and worked as in the preceding case, so that when the portion of the cylinder above the piston is in communication with the hot well, it will be cut off from the condenser, between which and the portion of the cylinder beneath the piston, communication will

be opened, and cut off from the hot well, whereby the water of condensation will be drawn from the condenser and ejected into the hot well at both strokes of the piston.

The patentee proposes to disconnect the shaft of paddle-wheels or other propellers, and to work them by separate and independent engines, also to pass the worm shaft up to the deck, so that the wheels may be worked by variable power, or caused to act in different directions, as required.

The last improvements specified by Mr. Leigh refer to steam boilers and steam-boiler furnaces, and consist in substituting for the ordinary brick setting, metal chambers, which support the boilers and contain the feed water, which is consequently heated before its entry to the boilers. The chambers are open at top to the atmosphere, to prevent any dangerous accumulation of steam therein.

The doors of the furnace are fastened on a rod, which receives a slow vibrating motion from the steam engine, and are provided with ledges projecting inwards underneath the outlet of the coal hopper, so that when the door moves back, the hopper will be opened and the coals allowed to fall through on to the dead plate, whence they will be pushed on to the fire-bars, and the hopper closed by the forward movement of the door. The fixed furnace bars are constructed in the ordinary way, while the place of every other one is occupied by two rocking-bars, placed one behind the other, and attached to rods which are connected to the vibrating frame, whence they derive their motion and impart it to the rocking-bars. Behind the bridge of the furnace are placed tubes, arranged alternately in horizontal and vertical positions, and communicating at both ends with the boiler.

*Claims.*—The mode of mounting the oscillating cylinders of steam engines on pointed or other centres, not being steam passages. The steam being admitted by pipes, as described, or by other equivalent and suitable arrangements.

2. The mode of surrounding the cylinder with a steam jacket, into which the steam is passed previously to its being discharged into the condenser or atmosphere.

3. The use of flexible pipes for conveying the discharged steam from the jacket to the condenser.

4. The mode of mounting the slides upon the cylinder, which admits of their being always in view.

5. The method of mounting the expansion valve, whereby the throttle valve is dispensed with, and the steam thoroughfare opened to the full extent at any moment of the stroke.

6. The mode of connecting four cylinders to the same shaft, to dispense with the use of a fly-wheel.

7. Making the cylinder lid and gland hollow.

8. The adaptation to the air-pump of a slide valve, similar to one before described, whereby communication is alternately established between either side of the piston, and the hot well, and the condenser.

9. The employment of hollow metal sides to support the boilers, instead of the ordinary brick setting.

10. The mode of feeding the furnace with fuel by means of vibrating doors and projecting ledges.

11. The arrangement of oscillating fire-bars.

12. The method of transmitting power by the arrangement of cranks and connecting-rods, as described.

13. The mode of working paddle-wheels, or other propellers, by connecting them to separate and independent engines, in order that variable degrees of power may be applied, or that they may be caused to act in opposite directions.

HIRAM TUCKER, Roxbury, Massachusetts, U.S. *For a certain new and improved manufacture of mantelpieces.* Patent dated November 2, 1849.

The patentee in this case has ornamented the heading of his specification with certain specimens of his artistic skill, which are, we presume, at the same time, emblematically expressive of his national aspirations. The British lion and unicorn are represented in one corner huddled together for mutual support, with the shield clumsily set between them, and glancing askance at the American eagle, which occupies the other corner, bearing in its talons an escutcheon ornamented with the stars and stripes, and intent apparently on making one fell swoop upon its terrified foe. To neutralise, however, the effect of this allegorical representation of what the future has in store for us, the flags of the respective States are joined together in the centre.

The invention has for its object the manufacture of cheap mantelpieces in imitation of marble and other kinds at present in use, and is effected by making the frame of cast iron, with rebates to hold plates of glass, on the back of which, an imitation of marble or other material, or a landscape or other design is painted or stained. The plates are retained in position by plaster of Paris or other cement, and the metal work japanned or polished according to the design on the glass.

[A very palpable copy of one of Miss Wallace's many beautiful methods of household decoration. (See *Mech. Mag.* vol. xlix., p. 224.)]

*Claim.*—The new article of manufacture

produced as before described. [Here follows a long statement of the merits of the invention.]

REUBEN PLANT, Holly Hall Colliery, Dudley, Worcester, coal master. *For improvements in making bar or wrought iron.* Patent dated July 13, 1849.

(For specification see *ante* p. 61.)

JAMES USHER, Edinburgh, gentleman. *For improvements in tilling land.* Patent dated July 18, 1849.

*Claims.*—1. The application of a series of curved ploughs in the same plane around an axis, so that such ploughs shall come into action in succession.

2. The constructing of machinery for tilling land, in which, on motion being given to the rotary ploughs or other tilling instruments, the resistance of the earth to the ploughs or other tilling instruments, as they enter and travel through the earth, shall cause the machine to progress along the land, as herein explained.

(For specification see *ante* p. 70.)

SAMUEL CUNLIFFE LISTER, Bradford, York, Esq., and GEORGE EDMOND DONISTHORPE, Leeds, York, manufacturer. *For improvements in preparing, combing, and spinning wool.* (A communication.) Patent dated July 18, 1850.

The improvements which form the subject of the present patent are—

1. The application of several apparatuses instead of one only, as has hitherto been customary, to the feeding of wool in even accumulations on to the pointed surface of a cylinder, whence it may be doffed continuously, instead of being wound round, as usual.

2. Giving a lashing motion to the feed apparatus, before which the porcupine cylinder is caused to move slowly, whereby a comparatively large quantity of wool will be lashed on to the part nearest to the feed apparatus at the commencement, which will decrease as the distance between the porcupine cylinder and feed apparatus increases.

3. Preventing stress and injury to the combs, and the wool curling round them during the combing operation, by causing a plate to take in and out from between the rows of teeth, and thereby press the fibres against the head of the comb.

4. Applying plates to the holding-comb, in a similar manner as in the preceding case, during the action of the working comb.

5. The application of steam to wool for the purpose of fixing the fibres.

6. The application of dyers' tubes between the feeding rollers and the flyers or spinning instruments.

*Claims.*—1. The mode of drawing wool by rollers, as described.

2. The use of steam for fixing fibres of wool, drawn or extended by mechanical means.

*Specification Due, but not Enrolled.*

WILLIAM BROWN, St. James', Clerkenwell, machinist; HENRY MAPPLE, Child's-hill, Hendon, electric engineer; and WILLIAM WILLIAMS, jun., Birmingham, gentleman. *For improvements in communicating intelligence by means of electricity, and in improvements in electric clocks.* Patent dated July 18, 1849.

## RECENT AMERICAN PATENTS.

(Selected from the Report of Mr. Keller, in the *Franklin Journal.*)

FOR AN IMPROVEMENT IN STOVES FOR HEATING APARTMENTS. *James Shields* and *James Cole.*

The patentees say,—The nature of the first part of our invention consists in combining the chamber of combustion, in which the fuel of any desired kind is burned, with a drum or chamber for the combustion and circulation of the inflammable matter evolved from the combustion of the fuel, by means of what we term a "throat," through which the products of combustion pass from the chamber of combustion to be inflamed in the said throat and drum.

The second part of our invention consists in admitting a jet or jets of atmospheric air to the throat which forms the communication between the chamber of combustion and a drum or furnace chamber, that the inflammable gases evolved from the combustion of the fuel, in the fire-chamber, may be mingled with the atmospheric air in their passage through the throat, and be thereby inflamed, and pass in an inflamed and inflaming state into the drum, or heating or working chamber of a furnace, that the flame may circulate beyond the throat, and then return to the exit pipe, which, in a vertical apparatus, is placed below the upper aperture of the throat, the equivalent position being retained when the position of the apparatus is changed, this arrangement preventing the flame from taking a direct course to the discharge pipe.

The third part of our invention consists in making the lower aperture of the throat larger than the upper aperture thereof, that the inflammable gases and atmospheric air may be the better co-mingled in their passage through the throat, and thereby insure a more perfect combustion.

The fourth part of our invention consists in making the throat with an enlargement between the lower and upper apertures, that the gases that enter the throat from the chamber of combustion may have room to mingle with the supply of atmospheric air before they pass up and out of the smaller aperture above into the drum.

*Claim.*—What we claim as our invention is, 1st, admitting atmospheric air to the throat which forms the communication between the chamber for the combustion of the fuel and the drum, that the inflammable gases evolved from the combustion of the fuel in the fire-chamber may be mingled therewith in passing through the said throat, and be thereby effectually inflamed, and pass in an inflamed and inflaming state into the drum.

2nd. We claim making the lower aperture of the throat, that forms the communication between the fire chamber and drum, larger than the upper aperture thereof, that the inflammable gases and atmospheric air may be the better co-mingled in their passage through the throat, and thereby insure a more perfect combustion.

And, finally, we claim making the said throat with an enlargement between the upper and lower apertures thereof, that the gases that enter the said throat may have room to mingle with the supply of atmospheric air before they pass up and out of the smaller aperture above into the drum.

(*To be continued in our next.*)

*Geological Prizes.*—The Council of the Geological Society of Dublin passed the following resolution on the 5th of December last:—Resolved: "That three prizes be offered by the Society, each of the value of five pounds in books, to be awarded for the three most valuable papers in the order of merit, that shall be communicated and read to the Society prior to the 31st of December, 1850, on theoretical or descriptive geology, or the application thereto of any of the kindred sciences." The competition is to be free to all persons, excepting only members of the council of the Society.

## LIST OF SCOTCH PATENTS FROM 22ND OF DECEMBER, 1849, TO THE 22ND OF JANUARY, 1850, INCLUSIVE.

James Usher, of Edinburgh, gentleman, for improvements in machinery for tilling land. Sealed, December 24; six months.

John Stroughton Christie, No. 13, Craven-street, Strand, Middlesex, Esq., for an improved construction of wrought iron wheels, and machinery for effecting the same. (Communication.) December 24; four months.

Richard Hobson, M.D., of Leeds, York, for certain improvements in the manufacture of horse shoes, and in apparatus for taking the measurement of horse shoes or horses hoofs." December 26; six months.

William Ackroyd, of Birkenshaw Mills, near Leeds, York, manufacturer, for improvements in dressing and cleaning worsted, and worsted mixed with cotton and other fabrics, after they have been woven. (Communication). Dec. 31; six months.

John Barsham, of Kingston, Surrey, manufacturer, for improvemects in separating the cocoa fibre from cocoa-nut husks. Dec, 31; four months.

John Christophers, of Heavitree, Devon, formerly merchant and ship owner, for improvements in naval architecture. Dec. 31; six months.

Alexander Brodie Cochrane, jun., and Archibald Slate, both of Dudley, Worcester, for improvements in the manufacture of iron pipes or tubes. December 31; six months.

Joseph Burch, of Craig Works, near Macclesfield, engineer, for improvements in printing on cotton, woollen, silk, paper, and other fabrics and materials. December 31; six months.

Winceslas Le Baron de Traux de Wardin, of Liege, in the province of Liege, in the kingdom of Belgium, for certain improvements in looms for weaving linen, woollen, and cotton cloths, and in machines for preparing the yarn for such cloths, before entering the loom, and in a machine for finishing gray and bleached linen cloths. January 3; six months.

William Henry Wilding, of the New-road, Middlesex, gentleman, for certain improvements in engines and machinery for obtaining and applying motive power. January 4; six months.

Charles Cowper, of Southampton-buildings, Middlesex, patent agent, for improvements in machinery for raising and lowering weights and persons in mines, and in the arrangement and construction of steam engines employed to put in motion such machinery; part of which improvements are applicable to other useful purposes. (Being a communication.) January 4; six months.

Reuben Plant, of Holly Hall Colliery, near Dudley, Worcester, coalmaster, for improvements in making wrought and bar iron. January 7; six months.

Samuel Colt, of Trafalgar-square, Middlesex, gentleman, for improvements in fire arms. January 7; six months.

Thomas Lightfoot, of Broadoak, within Accrington, Lancaster, chemist, for improvements in printing and dyeing fabrics of cotton, and of other fibrous materials. January 7; six months.

Thomas Richardson, of the town and county of Newcastle-upon-Tyne, chemist, for improvements in the manufacture of Epsom and other magnesian salts, also alum and sulphate of ammonia. January 11; six months.

Jerome Andre Drieu, of Manchester, machinist, for certain improvements in the manufacture of wearing apparel, and in the machinery or apparatus connected therewith. January 14; six months.

Thomas Auchterlonie, of Glasgow, manufacturer and calico printer, for improvements in the production of ornamental fabrics. January 14; six months.

Andrew Barclay, of Kilmarnock, Ayr, North Britain, engineer, for improvements in the smelting of iron and other ores, and in the manufacture or working of iron and other metals, and in certain rotary engines and fans, machinery or apparatus as connected therewith. January 14; six months.

Peter Armand, Le Comte de Fontainemoreau, of 4, South-street, Finsbury, patent agent, for improvements in spinning fibrous substances. (Communication.) January 16; six months.

Joe Sidebottom, of Pendlebury, Lancaster, manager, for improvements in steam engines. January 16; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for certain improvements in pumps, and in machinery or apparatus for working the same, which latter improvements are also applicable for working other machinery. (Communication.) January 18; six months.

John George Barton, of Regent's-park, Middlesex, gentleman, for certain improvements in printing and dyeing materials. (Communication.) January 21; six months.

Robert Wilson, of Low-Moor Iron Works, York, engineer, for improvements in steam-engine boilers, and methods of preventing accidents in working the same. January 21; four months.

## LIST OF IRISH PATENTS SEALED FROM 21ST OF DECEMBER, 1849, TO 21ST OF JANUARY, 1850.

Osgood Field, of London, merchant, for improvements in anchors. January 3.

Peter Fairbairn, of Leeds, York, machinist, and

John Hetherington, of Manchester, Lancaster, machinist, for certain improvements in machinery, for preparing and spinning cotton, flax, and other fibrous substances. (Part communication.) January 12.

Richard Hobson, of Leeds, York, doctor of medicine, of certain improvements in the manufacture of horse shoes, and in apparatus for taking the measurement of horse shoes or horses hoofs. January 15.

John Jordon, of Liverpool, engineer, for certain improvements in the construction of ships and other vessels navigating on water. January 17.

Wenceslas, Baron de Traux de Wardin, of Liege, in the province of Liege, Belgium, for certain improvements in looms for weaving linen, woollen, and cotton cloths, and in the machinery for preparing the yarns for such cloths before entering the loom, and in a machine for finishing gray and bleached linen cloths. January 17.

Thomas Auchterlonie, of Glasgow, manufacturer and calico printer, for improvements in the production of ornamental fabrics. January 17.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Macgregor Laird, of Birkenhead, gentleman, for improvements in the construction of metallic ships or vessels, and in materials for coating the bottoms of iron ships or vessels, and in steering ships or vessels. January 19; six months.

William Beadon, jun., of Taunton, Somerset, gentleman, for improvements in conveying away or decomposing smoke and products of combustion from stoves or grates, and in ventilating rooms of residences. January 19; six months.

George Simpson, of Buchanan-street, Glasgow, civil and mining engineer, for a certain improvement or improvements in the machinery, apparatus, or means of raising, lowering, supporting, moving, or transporting heavy bodies. January 19; six months.

William Wood, of Over Darwen, Lancashire, carpet manufacturer, for improvements in the manufacture of carpets and other fabrics. January 23; six months.

Christopher Nickels, of York-road, Lambeth, Surrey, gentleman, for improvements in the manufacture of woollen and other fabrics. January 23; six months.

Walter Westrup, of Wapping, Middlesex, miller and biscuit baker, for improvements in cleaning and grinding corn or grain, and in dressing meal or flour. January 24; six months.

Auguste Reinhard, of Leicester-street, Leicester-square, Middlesex, chemist, for improvements in preparing oils for lubricating purposes, and in apparatus for filtering oil and other liquids. January 24; six months.

Joseph Long and James Long, of Little Tower-street, London, mathematical instrument makers, and Richard Pattenden, of Nelson-square, Surrey, engineer, for an improvement in instruments and machinery for steering ships, which is also applicable to vices, and other instruments and machinery for obtaining power. January 24; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Jan. 19 | 2153 | Joseph Gray and Henry Lawson | Sheffield | Continuous stream enema-fountain syringe. |
| ,, | 2154 | Robert John Blyth | Eagle Foundry, Norwich | Corn-thrashing drum. |
| 22 | 2155 | John Roberts | Eastcheap | Ventilating flower-pot. |
| ,, | 2156 | Henry Charles James, | Oxford-street | Collapsible trunk or portmanteau. |
| 23 | 2157 | John Samuel Phene | Cambridge | Hook and eye. |
| ,, | 2158 | James E. Mac Cabe | Parliament-street | Covers and backs for binding, or the temporarily binding pamphlets, &c. |
| 24 | 2159 | Joseph Welch and John Margetson | Cheapside | Equestrian or driving poncho. |
| ,, | 2160 | Henry Burrage | Bath-buildings | Triangular ventilating top. |

## CONTENTS OF THIS NUMBER.



LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London, and 99B, New-street, Birmingham. —Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

# Mechanics' Magazine,

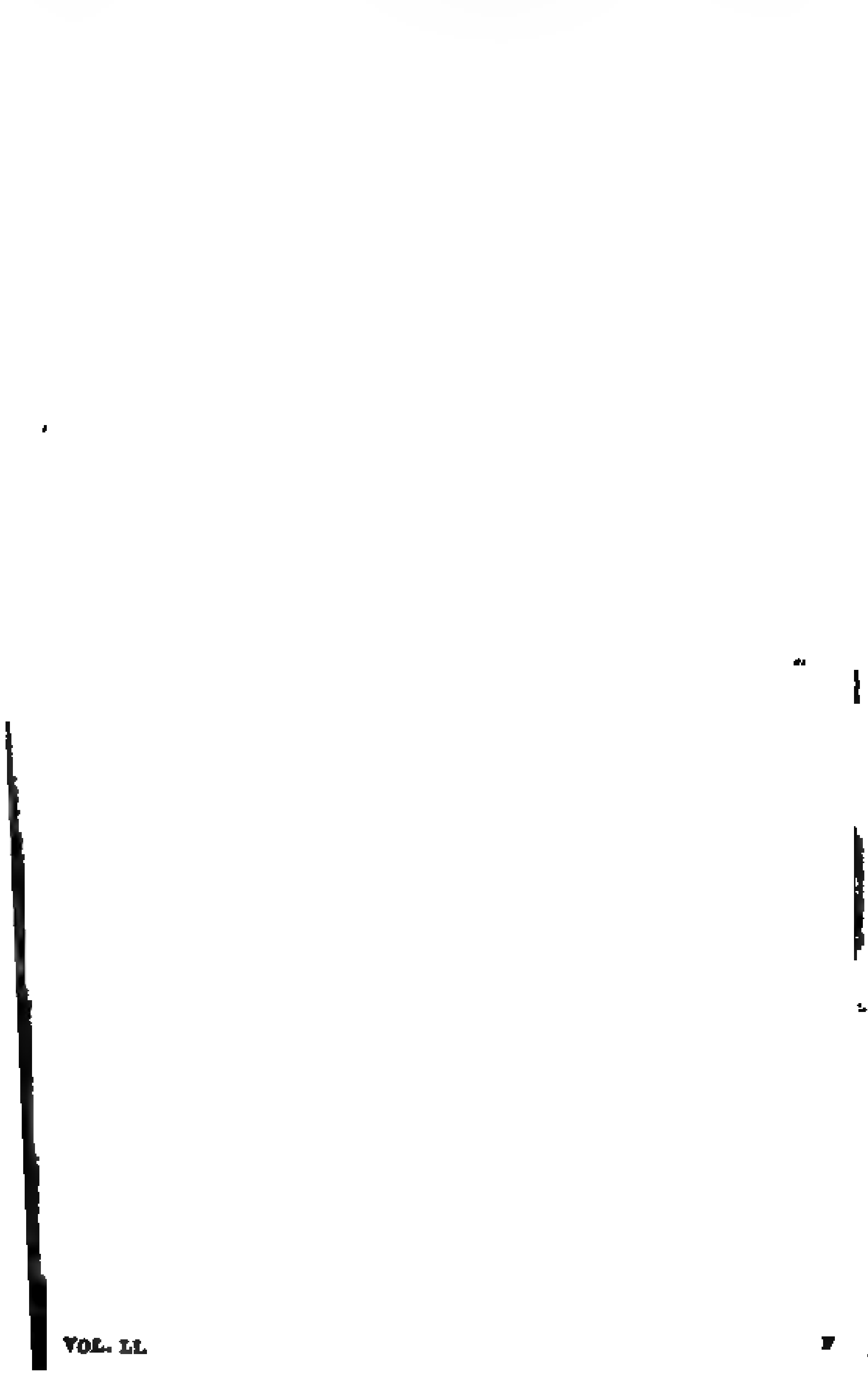
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1382.] SATURDAY, FEBRUARY 2, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## BESSEMER'S CENTRIFUGAL DISC-PUMP COMBINED WITH OSCILLATING STEAM-ENGINE.

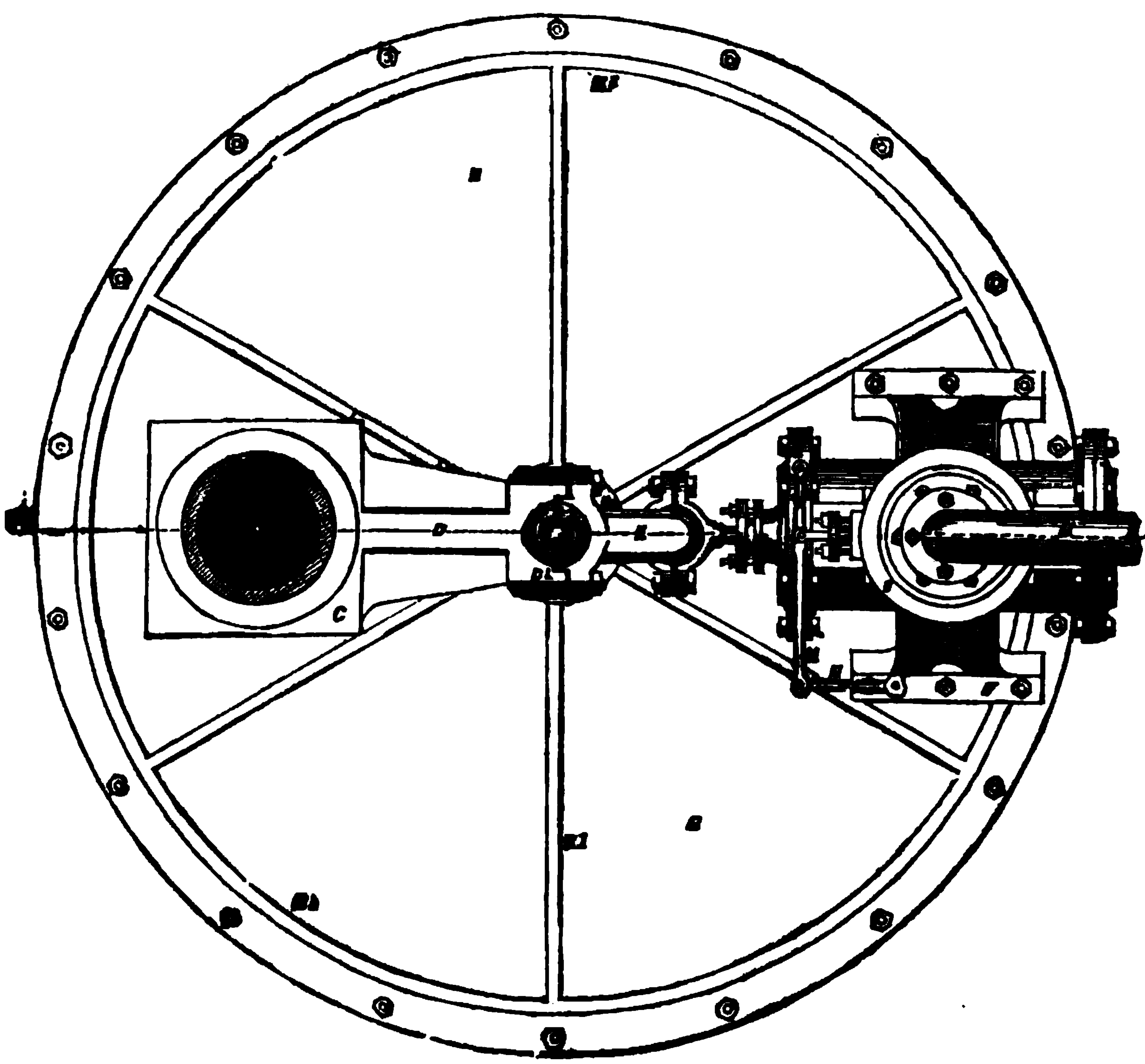
Fig. 1.



BESSEMER'S CENTRIFUGAL DISC-PUMP COMBINED WITH OSCILLATING STEAM-ENGINE.

In our description of Mr. Bessemer's ingenious centrifugal disc-pump (*ante* p. 21) various methods were shown how the power of men and horses might be applied to the raising of water by means of the pump alone; but in those cases where the power of steam, water, or wind can be better made use of for the purpose, Mr. Bessemer prefers to combine these first movers, one or other of them, in such manner that the same revolving shaft, which constitutes part of the first mover, shall also form the revolving shaft of the centrifugal disc pump. The idea of this combination is a very happy one, inasmuch as it obviates all the cost, wear and tear, loss of power, and liability to derangement, attendant on the employment of intermediate gearing.

Fig. 3.



Figs. 1, 2, and 3, show the disc combined in this manner with an oscillatory steam engine, and forming in this case the fly-wheel—the disc being of iron cast in one piece, and of large diameter, so that a great amount of centrifugal force may be generated without any great velocity of the shaft.

Fig. 1 is an elevation of the apparatus; fig. 2, an elevation, partly in section, on the line AB, of fig. 3, a plan. A is a strong cast-iron cylindrical vessel with a cover B bolted thereon by a flange extending around it. The cover is strengthened by six radial ribs B 1, which unite in a central boss B 2, and at their outer ends join the circular ribs B 3. On the cover B there is bolted a hollow column C, which forms

part of the rising main, and has a bracket D projecting therefrom, which terminates in a plummer block D 1, and supports the crank-shaft E. On the side of the cover B there is an arch-shaped piece of framing F, for the purpose of supporting the upper trunnion of the oscillating steam cylinder G, which is of the usual construction of high-pressure oscillating cylinders working on hollow trunnions, and having stuffing-boxes to prevent the escape of steam at the trunnions. But as the cylinder here represented oscillates with its trunnions in a vertical position, it is necessary to support the lower trunnion in a somewhat different manner to the upper one, and for this purpose the small vessel H is bolted to the cover B, which vessel H is provided with a gland I, and is packed steam-tight in the usual way. The lower end of the trunnion has a hollow space formed in it, and a corresponding hollow is made in the bottom of the vessel H. A steel ball J is fitted into these hollows, and both serves to support the cylinder, and to form an easy joint for it to oscillate upon.

Around the lower part of the trunnion there are slots K, through which the waste steam passes into the annular space H 1 in the vessel H, and finally makes its exit by the pipe L. The motion of the cylinder on its axis imparts motion to a D slide valve in the box P, through the medium of the levers M and N, the end of the lever M 1 being fastened to a stud Q on the cylinder. The piston rod is connected to the crank E in the usual manner. To the under side of the vessel A there is bolted a suction pipe R, provided with a foot valve of the usual construction used in pumps; and from the inside of the vessel A there projects upwards a mouth-piece A 1, which is made to fit closely to the central opening, S 1 of the disc. The lower part of the crank shaft E works in a step formed in a boss V, which occupies the centre of the opening leading into the disc. This boss is supported by four elliptical arms X, which are cast across the opening A 1. The boss V terminates in an inverted cone, to lessen the obstruction caused to the passage of the water past it, which will not be great, because the arms and cone occupy an enlarged part of the pipe. The disc is keyed to the crank shaft at E 1; and to prevent the escape of water past the shaft where it enters the vessel A, a hydraulic leather (Z) is fitted to the boss B 2, the upper part of which is hollowed, and forms an oil cup. Steam being supplied through the pipe U, and the engine set going, the large heavy disc S will regulate its motion, and at the same time throw off water from its periphery in the same manner as in the other forms of disc pumps before described.

## ON PUBLIC TASTE, AS LIKELY TO BE AFFECTED BY THE GREAT EXHIBITION OF 1851.

Whatever else may be doubtful in the "National Exhibition" scheme, doubt there can be none at all, of its being deemed a highly reprehensible one by John Ruskin, it being got up in utter defiance of one of his strongest points of doctrine; and he must inwardly groan at the deplorable obtuseness of those who prefer their own owlish darkness to the intellectual radiance of his "Seven Lamps." Most disagreeably must he now be convinced that the "eloquence" for which his reviewers have given him credit so liberally, has been expended in vain—has failed to produce the slightest impression in what are termed influential quarters, since there his philosophy is practically scouted. Hardly need we say that Mr. Ruskin has no sympathy for manufactures and the manufacturing arts, which he seems to think are already encouraged vastly more than they ought to be; wherefore he is, no doubt, scandalized at those who are pleased to talk of "the mercantile value of art,"—for which phrase he would, perhaps, substitute "MATERIALISM OF ART," as the more honest one, and in itself not at all more offensive to ears polite, since the other smacks too much of the trader and the market. The kind of art referred to by those who lay so much stress upon its mercantile value, is at the best a very subordinate one,—not, indeed, to be wholly disregarded, since it ministers to the comforts and elegances of every-day life. Yet the taste for it is so hardy as to require little cultivation or forcing; neither does such taste at all lead us of course to a feeling for sterling art, or what is called fine art. Ministering to that passion for ostentatious display and self-seeking indulgence, which requires rather to be repressed among us than

sedulously followed, the merely ornamental arts are apt to beget more of purse-proud taste than any other—that which, equally insensible to æsthetic beauty or deformity, has no other standard of merit than the vulgar one of cost and money value,—of showiness or fashion. Somewhat, too, of similar judgment and feeling is allowed to mix itself up even with the fine arts themselves, whose productions are frequently prized quite irrespectively of any intrinsic æsthetic value or interest, and only according to their history, their rarity, their real or supposed genuineness, and the prices at which they have been bought. Even in the National Gallery there are some things that are worthless, or worse,—things that can find favour only in the eyes of picture-dealers or picture-collectors. And if, in matters of fine art, *prejudice*—for we can give it no better name—is permitted to exert an influence that is anything but salutary for the advancement of art, fashion exerts a similarly unhappy influence over the manufacturing and ornamental arts,—an influence which they cannot shake off even if they would, but which, so far from attempting to shake off, they rather help to promote and confirm.

Fashion itself, we may observe, is of comparatively quite modern origin, and all but wholly different in its nature from costume; for whereas, in its slowness of growth and subsequent durability, the latter may be likened to the oak of the forest, the modes of the other spring up like mushrooms, and decay again as quickly. Fashion, in the popular meaning of the term, hardly existed at all in either the classical or mediæval times. Changes in taste there were, but gradual ones; first those of onward progress and development, afterwards those of decline; but none of the sudden and violent ones which now take place at the mere bidding of Fashion, which

"Is everything by turns, and nothing long."

For such continual mutation there would be some excuse did it proceed from extraordinary fertility of invention, and a superabundance of new ideas; yet although there is no lack of invention amongst us as regards the useful arts and utilitarian improvements, we show scarcely any power of invention in those of ornamental design. Those who practise the latter are fain to answer the demand for novelty, not by exercising any faculty of their own, but by falling back upon some forgotten and exploded mode, not for the purpose of borrowing hints from it, or of treating it more artistically than it had been done originally, but merely to reproduce it *statu quo*, and bring it again into vogue under the sanction of some distinct and taking name for it. Thus, in all that belongs to furniture and decoration, we are by turns furiously classical or as furiously mediæval: one day Greek is "the rage," another Gothic; anon, Elizabethan and Rococo are taken into favour; then, again, Louis-Quatorze or Quinze, with their gorgeous trumperiness, till, still craving for variety, though unable to produce it ourselves, we seize upon Alhambra patterns as a *pis aller*. Nay, so omnivorous is our taste, and so indiscriminating, that specimens of all those opposite modes may sometimes be seen huddled together in the same apartment, and found seasoned, to boot, with more than *quantum suff.* of cockneyism.

So bandied about from one thing to another, and directed to go in such opposite directions, no wonder at all is it that taste should get bewildered, more especially as no principles are thought of for it by which it might steady itself. How, indeed, is it possible, so long as the perpetual *see-saw* of mere fashion is kept up, that permanent good taste should be established? For, if good taste be got at one day, it is dismissed almost the next, as being *passé* and out of date. What causes fashion to work well for trade and productive industry, causes it also to operate anything but beneficially as far as sound and settled taste is concerned. In fact, it is to the mutability and caprices of fashion that many trades look for the chief demand and a constant one for the articles they supply, those articles being such as to last indefinitely, and to be every whit as useful as when first new. Thanks, however, to fashion, the "most charming" things of the kind are, after a brief while, discarded for something newer, even although that newer should be also something worse.

Could fashion be kept down,—could people but be persuaded to pay less regard to what is merely fashionable, and more to intrinsic beauty and merits of design, we might fairly begin to look for

improvement—slow perhaps, yet progressive—in the taste of the general public. As far as the latter are concerned, they are likely to be rather bewildered by the vast variety of objects that will be presented to them at the All-Nation Exhibition of 1851, than at all instructed or improved; and another probability is, that much of the worst taste will obtain the greatest number of admirers. It will be well, too, if those who will have to pronounce judgment officially by awarding the prizes—should not that *extravagant* part be now abandoned*—be not bewildered also, and commit some mistake. Most difficult it will be, or would have been, for the juries to arrive at impartial and unanimous verdicts with regard to those productions which appeal chiefly to fancy and taste. Would differences of opinion be settled by the ballot-box, and with closed doors? Or would the public be allowed to know what were the several individual opinions, and by what arguments they were respectively supported?

Of the doings of irresponsible committees, and of management kept entirely behind the curtain, we have had experience enough in architectural competitions; for, with an occasional exception, the final decision—which is all that is permitted to transpire, has been more or less unsatisfactory, and in some instances quite as *unaccountable* as the committees themselves. In more than one case, committees of the kind have suddenly repented them, and after bestowing premiums, have cancelled their first decision, thrown the matter again open to competition, and at last chosen either something quite different from what they had previously done, or what they had before overlooked; or else—strange to say, have persisted in their former choice in spite of public opinion, and notwithstanding the intention explicitly professed by the mere circumstance of a second competition.* If such instances do not show that there is much intriguing and manœuvring in matters of the kind, they certainly do show that there is a great deal of perplexity and indecision attending them, and that so far from being infallible, committees are apt to blunder egregiously. And who will promise us that sound and impartial judgment will be manifested in awarding the premiums—be they either pecuniary or merely honorary ones—at the Monster Exhibition of 1851?

It is not yet known whether the premiums are to be adjudged before the opening of the Exhibition, or not until after it is closed. If the former and more usual course be adopted, the juries or umpires will have a most onerous task, (for a task it will be merely to reconnoitre such a vast assemblage of articles,) and unless several months were allowed them, they would hardly have time to do more than reconnoitre them; whereas, their formally-delivered opinions ought to be the result of the most careful examination and diligent comparison, and should be all the more well considered, lest they should run quite counter to the after-opinions of the public. On the other hand, the greater part of the public would be so biassed by the pre-judgments of the official umpires, that they would be strongly prejudiced in favour of the productions so distinguished, and prejudiced against similar ones of nearly, if not quite equal merit.

People are likely to be greatly disappointed if they go with the expectation of finding decided improvement in the several manufactures. Fresh talent and superior taste to what there is now among us, will not spring up all at once, even at the bidding of royalty itself; while as to existing talent, it has as much to unlearn as to learn. Our *ornamentistes* of all classes show themselves to be only very imperfectly acquainted with the principles of artistic composition and design; nor do our schools of design teach them—the instruction they impart being confined to the mere A B C of design. Ornament—or rather, skilfully-drawn and executed pattern, is made

* The *Times* has at length permitted some one to protest (in a letter signed "An Engineer") against the absurdity of pecuniary premiums; so obviously objectionable in every respect, that it is wonderful they should have been seriously thought of even for a moment. Another most decided and serious objection to prizes or premiums of any kind is, that they would be bestowed, not on actual skill and talent, but on *capital*; in other words, would be given, not to either the designer or the executive workman, but to the manufacturer who employs him, and who even now reaps all the credit of the skill or taste shown in what he sends forth to the public.

* The competitions for the Royal Exchange, the Army and Navy Clubhouse, and the Nelson Column were conducted after this fashion, and as regards the last mentioned, the second competition was little better than a solemn hoax on the competitors and the public.

everything, though it is frequently so profuse and so preposterously applied, that it encumbers and disfigures instead of decorating. Ornament should be to the thing ornamented what seasoning is to food; used indiscriminately and in excess, it disgusts rather than pleases. We have of late begun to relapse into that vicious taste of extravagant and frivolous embellishment which we at one time laboured hard to extirpate; and striving to get away from it as far as possible, ran into the opposite extreme of frigid plainness and excessive boldness, which it pleased us to dignify by the names of purity and simplicity. Tired of "motley," we betook ourselves to "drab;" and a precious drab and drug also simplicity became. The taste for motley is now springing up again; we find it patronised by those who set up for leading authorities and public instructors in all other matters of art and taste. Nothing, surely, can be in worse or more imbecile taste than many of the specimens of ornamental design—or rather, workmanship, which have been not only shown, but actually pointed out for admiration in the *Art Journal.* Shown they might have been with great propriety, had it been for the purpose of rendering them in one respect useful lessons, by explaining their various defects. Although the *Art Journal* itself says that good taste is just as cheap, or cheaper, than bad—a truth no one who has intelligence of art will dispute—it takes no pains to make its own illustrations exemplify such doctrine, for they mostly exhibit very expensive, tawdry, sometimes downright ugliness, and almost at the best, only hackneyed ideas hashed up afresh. Either, then, that oracle is rather behind than at all in advance of average good taste, or that average must now be exceedingly low. Although not at all given to be critical, even the *Builder* has ere now ventured to put forth a protest—a very mild one —against some of the exceedingly queer furniture designs which the *Art Journal* had boasted of being favoured with!

Hardly do we know to what quarter to look for that superior intelligence and taste which should preside over the Exhibition scheme. Rank, station, names, are no pledges for them; for we do not find that committees of "noblemen and gentlemen" manage at all better than, if sometimes so well as, those which are far less dignified. Even if we go higher than nobility, we shall be puzzled to discover any particular superiority of either judgment or taste. Of this, Buckingham Palace is proof irrefragible, for however it may have been improved with respect to mere commodiousness, it is, as a piece of architecture even more unsatisfactory than ever, and is universally condemned;* and not least of all so, by that "eloquent silence" which assures us that not even the flunkiest scribbler of "art-criticism" dares venture to bestow a compliment upon it. If, therefore, as may fairly be presumed, the Prince Consort was at all cognizant of Mr. Blore's design for the alteration, we can say little for his taste—at least, in architecture; and the only compliment we can pay His Royal Highness is, that he is capable of hearing a little honest uncourtly truth with perfect composure and magnanimity. Hoped it is to be, that he will leave the umpires to form their own decisions altogether, uninfluenced by any opinion of his, lest they should interpret the slightest expression of opinion from him into a significant hint intended to be received as a sort of royal command. In consequence, perhaps, of his foreseeing many awkward embarrassments, the noble President of the Institute of British Architects has declined the honour of being made a member of the Commission.

Let it not be imagined that we are wickedly quizzing, when we give it as our opinion that there ought, in all fairness, to be a sprinkling of the fair sex among the judges, since the Exhibition will comprise a great many specimens of manufacture belonging exclusively to their connoisseurship. They must surely be the very best judges of silks, and laces, and trinkets, and all the innumerable articles which constitute female finery; and which, with the exception of those who manufacture them, and of men-milliners, men either are ignorant, or else affect not to understand.

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* What is to be done with that bit of former extravagance, the marble arch, is not yet determined, or, if it be, is not distinctly made known,—perhaps in order to keep gossiping alive, and to let people amuse themselves with making suggestions for its ultimate disposal. It seems as if that arch and the gateway of the British Museum are very ceremoniously waiting to give each other precedency in making their departure.

As regards the *locale* or building that must be provided for the Exhibition, it is stated that a model of a structure for the purpose has been prepared by Mr. Turner, of Dublin, and is about to be submitted to the Prince Consort. According to the description which has been given of it, it is for an edifice about twice as large as the new Palace of Westminster, with five rotundas, and their domes 200 feet high, but the height of the central one would be further increased to 260, (or only 40 feet less than what Mr. Barry intends to carry up the Victoria Tower), by a colossal statue of Atlas bearing a globe, which figure would consequently be 60 feet high! No doubt the idea is as original as it is classical, but it is to be apprehended that its meaning would be grossly misinterpreted by many, for they would say that it was intended to represent John Bull groaning beneath the weight of the national debt. The projector wishes that the building should be a permanent one, constructed almost entirely of iron—painted, we suppose, to look like stone; and that it should be erected in the Green Park, of course greatly to the satisfaction of the Earl of Ellesmere and others, whose mansions are there situated; and greatly to the advantage of Buckingham Palace. To say nothing of the cost of such a structure, and the time it would take to complete it, the scheme is so absurdly extravagant and extravagantly absurd, that remonstrance against it becomes superfluous. L.

### IMPROVEMENT IN THE DRAINAGE OF SEA-COAST TOWNS.

Sir,—I have been spending a few weeks at one of the beautiful watering-places on the coast of our sea-girt isle, and although not a single case of cholera has occurred in the town or its immediate neighbourhood, I found the residents, and some of the visitors who take a lively interest in the place, wisely participating in the sanitary movement, instead of waiting, like the inhabitants of most of our large towns, for a hard lesson in the school of experience.

On the esplanade, and in the houses along the shore, there is a very offensive smell, and the visitors are industriously told that it is the smell of the sea-weeds which are thrown up in great abundance by the sea. I soon ascertained, however, that it is no such thing, and when I had gained the confidence of one or two of the inhabitants, they acknowledged that I was right. The circumstances are these:—The drains from the town run direct down to the shore, and terminate on the beach in wooden sluices. These sluices open eight or ten feet below high water mark; the inclination of the shore is exceedingly gradual, and consequently when the water is down, there is a considerable extent of "sands" between the sluices and the sea. Sewage is continually running from them, but it is not observed, because it immediately disappears in the shingles. Having percolated these, it comes out at the bottom of the beach, and commences its journey over the sands; and these sands being longitudinally almost on a water level, there is little tendency to form a channel, and being also furrowed with the wave-ripple at right angles to the direction of the incline, the sewage is spread over a very considerable area—many acres; and when the wind blows in from the sea, over this mixture of sewage and sea-water, the cockney who is accustomed to have the articles pure from the gully-holes of the metropolis, does not recognize it, and is easily persuaded that this disgusting smell arises from the sea-weeds.

In describing the circumstances of this watering-place, you will perceive, Sir, that I have described the circumstances of a great many of the towns on our coast. In some cases, the sewage which escapes while the water is below the mouths of the sluices, is accumulated in the harbour and on the mud around it, and when the tide recedes the stench is intolerable. The remedy I am about to propose is simple, inexpensive, and effectual, and is applicable wherever the elevation of the water varies a few feet.

I propose to place along the shore, immediately below the mouths of the present drains, a main sewer to receive at all times their discharge. This sewer must, I think, be constructed of wood in the same manner as the present sluices, on account of the local circumstances. It would, however, have little or no fall, and herein consists the whole difficulty of the case. To remedy this, I propose that a reservoir be constructed at one end of this main sewer, which is to be left open at the other. The bottom of the reservoir is to be on a level

with that of the sewer, and the top of it is to be as high as the water at high tide. In the bottom of the side of the reservoir, next to the sea, there is to be a valve opening inwardly, sufficiently large to allow the water to rise in it as the tide rises. The reservoir is to be shut off from the sewer by a small floodgate. When the tide has filled the reservoir, and has again subsided a little below the mouth of the sewer at the opposite end, the floodgate is to be opened, and the sewer will immediately be most effectually flushed. This being done, as soon as the tide has fallen a little below the mouth, the discharge will enter the sea at once, and no annoyance can be experienced. It would, however, be as well to extend it a little beyond the limit of the town. The dimensions of this drain would be about 18 *in.* × 13 *in.*, and supposing it to be a mile long (the present extent of the town to which I more particularly refer) the reservoir should be about 40 × 40 × 8 feet. As the whole of this would be of timber and very roughly constructed, the reservoir being a sort of coffer dam, it would not cost a tithe of any plan that has yet been proposed for the removal of this great nuisance from the most valuable part of the town, and as the principle is applicable wherever there is a tide of a few feet, and sanitary measures are now occupying so much public attention, I hope, Sir, you will deem this worthy a place in your very useful pages. I am, Sir,

One of your Earliest Subscribers,

M. F.

January 24, 1850.

## CONSTRUCTION OF SEA-WALLS.—THE MOLE AT GENOA.

Much as the different modes of forming sea-walls has been discussed, the subject does not seem to be exhausted; nor can further details be considered as superfluous, the formation of safe and cheaply-made harbours being of great importance to the maritime prosperity of the nation; the paper, therefore, which appeared in No. 1376 of the *Mechanics' Magazine*, promises to be of much use, for it draws attention to the mole at Genoa.

That work, it appears, is a compound of the long slope of loose stones with the vertical wall of masonry.

In the quotation from Sir Hugh Cholmondeley, it is said that, "It is certain in deep water, where seas fall with great weight, no body that is contiguous can be made of sufficient strength; for the thickness of the wall is of small consideration, because the sea will first shake, then loosen the wet stones, and afterwards fetch down the upright wall little by little." This being simply an enunciation of Sir Hugh's own opinion, it seems unnecessary to canvass this part of the quotation; but in the latter part of it facts are stated which are important. The wall at the mole of Genoa is said to be "near twenty yards thick, yet it is found of insufficient strength, and therefore at some distance from the mole they have raised a ledge of great rocks to take off the first force of the sea."

Were this the only paragraph relating to the mole at Genoa, it might be inferred that the massive wall so described had been raised perpendicularly from the very bottom of the sea; but from the quotation of page 52, it appears that the wall of masonry stood upon stones thrown loosely together to form its site.

The depth of water in which the mole is constructed appears to be 60 feet, about 43 feet of which was filled in by throwing down stones, which, of course, formed slopes on the faces of the ledge, more or less long. When this heap was raised to a certain height, divers were employed to level its surface, and to bring it to within about a foot of the draught of water of the caissons. The caissons, drawing about 16 feet water, were then brought over the mass of lava stones, sunk upon it, and a wall built within them to the required height. Thus, below the surface of the sea there were first from the bottom 43 feet in height of long slope, and upon it, up to the level of water, 17 feet of perpendicular wall built in caissons.

This combination of the loose stone long slope and of the upright wall, having been considered as likely to be eligible by very eminent engineers, the effect in actual practice of this mode of structure is, therefore, well worth investigation: it has, to a certain extent, failed at Genoa, but the *cause* of that failure does not appear to have been inquired into. It being, however, of general importance in harbour making, further information respecting the mole of Genoa seems highly desirable—not opinions, but facts.

There is no tide in the Mediterranean, as is well known. Southerly winds are

said occasionally to raise the water on the north shore of it, sometimes as much as three feet. The usual causes of disturbance on the shores of that sea are currents. It is said that a current sets in through the Straits of Gibraltar, passes along the southern part of the Mediterranean, and returns along the north side of it. This current is affirmed to be the cause of considerable deposits in the Gulfs of Genoa and Lyons—particularly to have been the great impediment to improvement of the harbour of Cette.

May not these currents wash away the loose stones from the foundation of the mole of Genoa, and thus have occasioned fractures in the wall of masonry built upon those loose stones? That they are washed away is evident; for Sir Hugh says of the outer "ledge of great rocks" (p. 49), "this they continually feed, at considerable charge, by bringing new stone to it every year;" and again (p. 52), "This mole they keep continually feeding with stone." If the maintenance of this rock of stones requires such continual feeding, it cannot be supposed that the 43 feet of loose stones under the perpendicular wall could have remained unacted upon: the natural inference, therefore, is, that the defects of the superincumbent wall have been, not from any imperfection of its own, but the consequence of its loose foundation having been washed away. The extracts afford no indication of what part of "the more polished work" had failed, or to what amount the damage had been; though, in opposition to the "continual" feeding of the loose stones, it is only said of the upright wall, "the defects of which they also repair as there is occasion for it."

It must be observed that, notwithstanding the expertness of Mediterranean div ers, they had not before the presen century the advantage of improved diving apparatus, therefore their operations under water could never be continuous; hence it may be inferred that in levelling heaps of stones, "chiefly" "from 5 to 15 tons" each, the divers could not effectuate a very even surface of the artificial rock; under such circumstances many a projection of it might have been sufficient to occasion the breakage of a superincumbent mass of masonry and wood.

The mole constructed at Cette many years ago was for the purpose of directing away the stones and shingle driven from the eastward along the coast. The work, when completed, was found to have produced a contrary effect; the pier was soon filled in behind it, and the harbour was choking up more considerably than ever, so that within these dozen years new expedients have been had recourse to; may not the stones with which the mole of Genoa has been fed, have contributed their share in doing mischief at Cette?

The mole of Genoa also involves the great question of, whether a long slope occasions waves to break injuriously against a structure opposed to them, or whether such a slope, on the contrary, protects an upright face beyond? But as the slope of the interior long one at Geneoa, was at its upper part 17 feet under water, it may not have had much influence in this respect, either in one way or the other.

One principal object of the paper in No. 1376 seems to have been depreciation of the buoyant mass wall at Sheerness; but however objectionable the structure of the mole at Genoa may have been, it affords no evidence relative to the Sheerness wall, since the manner in which they were constructed is totally dissimilar. The upright wall at Genoa was erected on 43 feet in depth of loose stones; the wall at Sheerness was not only carried down to the bottom of the sea, but also forced as far into the ground at its base, as could be effected by bringing upon every mass of 21 feet an immense temporary weight. There is another difference in effect between these two works; the mole at Genoa has to a certain extent failed, and requires frequent repairs; the wall at Sheerness remains, without any repair, perfect as at the date of its construction.

The principle on which the buoyant-mass wall was constructed does not seem to have been understood. In so far as its component parts were respectively buoyant, it differed no otherwise from the caisson of wood, than that the economical expedient was introduced of forming the caisson itself of brick or stone instead of wood, whereby the extra expense of the wooden case was saved. But the great principle on which the Sheerness wall was constructed was that of its being composed of *detached* masses, *in*dependent one mass of the other. They might be considered as

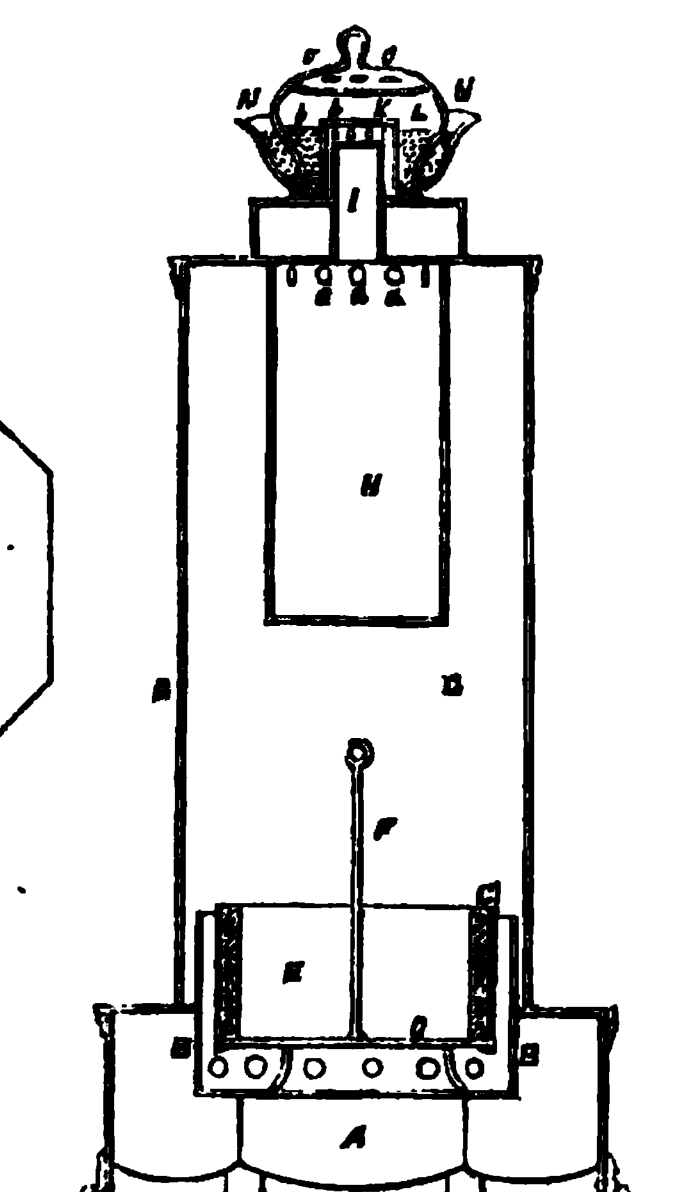
immense *piles*, each pile, so to call it, being more or less carried down and forced into the ground, according as the natural bed of the sea might vary in depth, or in supporting power. The mistaken notion seems to have been entertained, too, in regard to these buoyant masses that they were to remain hollow; whereas they were always intended to be filled in with cheap but indurating materials; filled in, that is, up to the height at which their vacuities might be made useful as store-cellars.

It is said in the paper to which this refers, that the "extracts will also show" in point of "time and economy, the insecurity of the caisson system." The mole of Genoa, according to the statement quoted, advanced less than 40 feet a year; but the wall at Sheerness,—though executed under all the disadvantages stated in No. 1374,—had advanced 200 feet in about fifteen months; but in proof of the unprecedented expedition this mode of building admitted of, a contractor offered to engage for the construction of a continuance of that wall at Sheerness, at the rate of no less than 200 feet running per *month*. That contractor was well acquainted with the work in question; he had been largely employed before by the Navy Board, and continued to be so afterwards with general satisfaction. In point of economy, the 200 feet of wall, on buoyant masses, was actually executed at less than a fourth part of the estimated expense of the same length of wall, if built in the usual mode; and the same contractor's tender, including all risks, was also at less than a fourth part of the cost of sea-wall built in the usual mode.

## THE NEAPOLITAN STOVE.

(Registered under the Act for the Protection of Articles of Utility. Mary Harvey, of Cornhill, Dorchester, Ironmonger, Proprietor.)

Fig. 1.



F.g. 2.

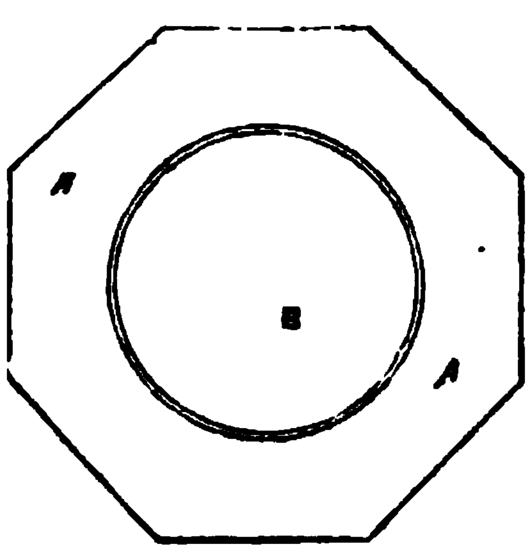


Fig. 3.

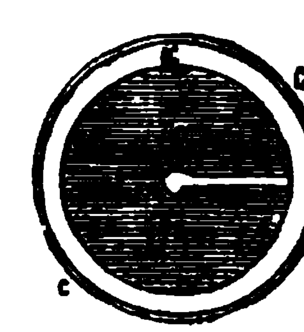


Fig. 1 is a sectional elevation of this stove. A is a basement given in plan in fig. 2. B is a cylindrical pan fitted into A, and connected with it. C is another cylindrical pan of somewhat less dia-meter than the pan B, within which it is placed; this pan (C) serves to hold the burning embers of a coke or char-

coal fire, for which purpose it is fitted at bottom with a grating D, and a ring of fire-brick E (fig. 3). F is a handle by which the pan and grate are lifted out of, or restored to their place. G is a cylindrical case forming the body of the stove; it is fitted at top with a check or spreader H. The heated gases arising from the fire pass upwards, and through the holes *a a a*, escaping by the pipe I into another pipe K, which is closed at top, but the gases have freedom to escape out of it by holes *b b* (formed near its upper end), into a compartment L of the head of the stove, which *compartment is filled with lime and water by which the carbonic acid is absorbed, and all possibility of danger from that source avoided.* The other and less injurious gases circulate around the sides of a deflecting pipe M, and escape by the holes *c c*; N is an outer condenser of the vessel, containing cold water, by which the compartment L is replenished as required, and humidity also imparted to the surrounding atmosphere.

## THE SUNDERLAND SIGNAL HOUSE.

[Constructed according to the registered design of Messrs. Thomas Meik, C. E., and Henry Watson, of High Bridge, Newcastle-upon-Tyne, brassfounder.]

Fig. 1. Fig. 2.

### *Description.*

Fig. 1 is a section of the tower, but showing only such parts as are necessary to describe the novelties in the structure Fig. 2 is an elevation of the same.

*a, a, a, a*, represents a web of wire gauze, of any suitable length, depending on the height of the tide, and of sufficient width (say 3 feet) to admit figures about 1 foot 9 inches high: each end of the web is wound upon copper rollers *b* and *c*. The float *d d*, has attached to it a copper wire rope, working over a spiral cone *e*—the rope having a sufficient number of turns to suit the rise and fall of the float; at the other end of the axle on which the spiral cone is fixed is a wheel *f f*, working into a pinion *g g* upon the axle of the bottom roller *b, b, b*, figs. 1 and 2. *h h* is a balance weight, to which is attached a copper wire cord, which, passes over a guide sheave to a spiral cone *i i*, round which it is wound, and the end made fast: at the opposite end of the same axle on which the spiral cone is fixed is a wheel *j j*, working into a pinion *k k*, upon the end of the axle of the top roller *c c*. When the float *d* rises with the tide, the balance weight *h* moves the whole apparatus in the direction of the arrows; and when the float falls with the ebb of the tide, the movements are indicated by the other arrows. As the tide ebbs and flows, the height is indicated by the figures on the web opposite the dial or sheet of plate glass *x, x, x*, &c.; and that these figures may be large and seen from a great distance, the web is made to travel 4 to 1 of the float, by means of the intermediate wheel and pinion *f* and *g*; and these figures (which are here made to indicate the feet and half feet of the height of the tide) are produced on the wire gauze by a white or light-coloured thin paint; the apertures of the wire gauze are left open, and the other portion or ground of the web is made black or other dark opaque colour, the apertures of the gauze being filled up. A web of any opaque material may be substituted for that of the wire gauze, and the part to form the figures or devices may be cut out and covered by any transparent substance or gauze; but the use of a web of copper wire gauze is preferred as being more durable, and not affected by the action of the sea air when applied to tide gauges; the figures thus produced on the web are distinctly seen in the day time (in whatever way the arrangement of them on the web may be varied), and at night, when lighted from behind by a strong light and reflectors, in the way that dials in general are lighted, the figures, or ground, as the case may be, are brilliantly illuminated, and can be seen from a great distance.

The utility of these novelties of configuration consists in this, that they produce more useful and conspicuous figures for tide gauges, or indicators for the use of ships entering or leaving a harbour or other places, and for railway signals, or other purposes where such gauges or signals may be useful.

## VICTORIA SUSPENSION BRIDGE, LOCHABAR.

(Abridged from the *Inverness Courier*.)

The opening of the Victoria Suspension Bridge over the river Lochy, between Fort-William and Corpach, was celebrated by a public dinner at Bannavie, on the 20th ult. —Sheriff Fraser in the chair, and Mr. Macgregor, banker, croupier. After the usua loyal toasts,—

The Chairman said that he would have the honour of proposing that evening two special toasts connected with the day's interesting proceedings—the first, as would be anticipated, was the health of Lochiel. Lochiel, as they all knew, was the chief of the Camerons, one of the oldest and most renowned clans of which the Highlands could boast. He was the owner of a valuable estate, handed down to him by a long direct line of ancestors—an estate of great extent, sixty miles long at the least, and embracing within its bounds a variety of stupendous mountains, beautiful lakes and valleys, and wide and rapid rivers; what was still more interesting, embracing, also, a numerous tenantry, many of them the descendants of the clansmen who fought and bled a hundred years ago at Culloden, with his ancestor, the "Gentle Lochiel" of the '45. Times were now changed, the sword had given place to the spade, and nothing now can so much conduce to the comfort and happiness of the people as the improvement of the soil. Lochiel has not been backward in seeing and acting upon this principle, and in showing by precept and example how the land can be turned to profitable account, and stimulating and encouraging his tenantry in industrious habits. In many places do we see improvements. In this immediate neighbourhood a handsome and commodious building, the New Inn of Bannavie, could not fail to be admired; but the last and greatest in the march of improvement was the elegant bridge over the Lochy, which was this day open for traffic. To any one who has had occasion to cross the river in the old ferry-boat, even in a calm, fine, dry

day, it was unnecessary to say that there was loss of time and much inconvenience experienced; but in a dark, wet, Lochabar night, how very much were all the disagreeableness of the ferry increased? The ferry has this day given place to the bridge, and Lochiel has thereby conferred, not on his tenantry merely, but on the public at large, an important boon.

The Chairman next proposed the health of Mr. Dredge. Having drunk the health of Lochiel, at whose sole expense the Lochy Bridge was erected, the next compliment was due to the eminent engineer who discovered the principle which distinguishes the Dredge suspension bridge, and who had just completed the largest bridge that had been erected on that principle. He would not attempt to draw a comparison between it and the bridges erected on the old system. He would say merely—what could not fail to strike every one present that day—that it was a peculiarly chaste and elegant structure. It consists of an arch of 250 feet span, resting on two massive arched piers of granite rock masonry at either end. Its situation was happily chosen, lying at the base of Ben-Nevis (the highest mountain in Britain), and near to the venerable ruins of Inverlochy Castle, once the residence of the kings of Scotland, the bridge has a highly picturesque effect. To a light and elegant appearance is combined strength of construction and durability of material; and it has the additional merit of not being costly. Another advantage connected with Mr. Dredge's bridges was, that they could be erected in an incredibly short space of time, as was apparent from the fact that the foundation-stone of the Lochy Bridge was not laid till August, and the fitting of the iron works was not commenced till the 1st of November, and now, on the 20th of December, the bridge was open for traffic—a triumph of skill of which the patentee might justly be proud.

Mr. Dredge, in reply, after thanking the company for the compliment paid him, observed that it was to Lochiel the compliment was due for his appreciation of and confidence in the new principle. After referring to the disadvantages of ferries, he proceeded:—"The confined limits of the stone arch for spanning broad rivers and ravines, with the difficulty of obtaining level roads over them, has kept it out of the reach of many a proprietor who would otherwise have gladly bestowed on the public the advantages of a bridge. Therefore in numerous instances, to their great prejudice, a great inconvenience has long been borne with. The timber bridge, it is true, is less expensive, but its durability is short, hence the rude ferry-boat is still a substitution for a bridge in various places, especially in the Highlands; but it might almost universally be now dispensed with; for the principle upon which the bridge has just been erected over the Lochy affords every person who wants a bridge the opportunity of no longer putting up with inconvenience; it is so truly economical, powerful, and durable, not of the costly stone material, nor of timber, which is calculated to last but thirty years, is it built, but of iron, the durability of which we cannot compute, as iron bridges are of modern date. A stone bridge at Lochy Ferry was estimated to cost 8,000*l.*—which sum, I believe, was the lowest tender. But it was to be composed of many arches, and as many piers in the river, obstructing its impetuous current, and probably damaging the valuable salmon fishings. The object is now attained with a level iron bridge, at a cost of less than 2,000*l.*, without the least obstruction to the current, whereby the liability of ever being overturned by flood or storm is avoided, and, consequently, its *first* will be the *principal* cost. The span of the bridge is 250 feet; platform nearly 17 wide; clear roadway 15; the masonry at the base 28 feet by 16 feet, and built solid up to the roadway 19 feet high, above which each arched entrance is 12½ feet wide and 20 feet high; and the top of the piers upon which the chains rest is 24 feet above the roadway, and the whole tapers three-fourths of an inch to the foot in elevation, excepting four feet of plumb which supports the arches. It is built of the best granite, of rock-work, without a tool-mark visible above the road. The care and attention of the workmen were devoted to making good beds and joints for the substantiality of the structure. The versed sine of the bridge is one-tenth of the chord line, and it consumed 40 tons of wrought and cast iron. The section of the four chains at the top of the piers is 50 inches, which taper to O at the centre of the bridge; hence its strength for transit use is 250 tons, namely, about one-third of its ultimate power. The platform contains 3,600 feet of surface, which will admit of 360 head of cattle being upon it at one time, and this will be the heaviest load to which it will be subject. Now, allowing each to weigh 4 cwt., the load will be only 72 tons, which will leave a surplus power of 178 tons. The foundation stone was laid on the 6th of August last, and, deducting the time lost by inclement weather and short days, the bridge was only three months in building. The first bridge on this plan was the Victoria, in Bath, erected in 1836, and now there are nearly fifty. The British and Indian Governments

have adopted it, and many others, as well as Lochiel, and it is beginning to be appreciated in every quarter."

### PUMPS WITH OR WITHOUT AIR-VESSELS.—SHALDER'S FOUNTAIN PUMP.

Two of your writers, who each styles the other "talented," being under a cloud themselves, have tried for above a dozen years to draw others after them. Shall I not do well to take one sweep with the brush of reason, when the cloud will be clean gone for ever? I allude to the late remarks in your popular work upon some very interesting matters—As, whether pumps should be with or without air-vessels? and the comparative speed of water in them.

*A pump 26 feet perpendicular with air-vessels:* Works 3 inch rising main, 1½ inch, and feed-pipe 1 inch in diameter. At the works, the water moves 1 foot, rising main 4 feet, whilst at the feed pipe it moves 9 feet upwards. Consequently the first foot movement at the works displaces 9 feet of air at the feed-pipe; the second 9 feet also; but near the end of the third movement, then comes the rub, *the water shuts the air-vessel, and the air therein being ever after securely retained, causes the pump to act as well as one with a 3-inch feed pipe, at about half the cost.*

*A pump of the like proportions without air-vessels:* With a shorter feed-pipe, commonly acts excessively, the works move slowly, and it delivers 14 ounces, the legitimate quantity. When the same movement is made quickly, 40 ounces of water are delivered with a uniform stream. *For air-vessels dilating or compressing at the works is a gain position.*—(To Mr. Hales, at p. 521, last volume.)

Metallic valves seem more likely to cause than to cure the shocks in a pump.

But to make a good pump with a piston sliding in a cylinder is impossible.

See the results of the air-dilator, as recorded in No. 1110, *Mech. Mag.*, at which time it had then been variously, numerously, and beneficially used about twelve years.

The above facts relate to the "New Perfect Rolling System," and in some measure to the old defective sliding plan, which after every modification for 2000 years, still remains a leaking, scraping, choking, uncertain, and inefficient system—a real disgrace to science.

I beg to quote the following, from the *Norfolk News* of July 7, 1849:

FOUNTAIN PUMPS.

Norwich may congratulate the human race upon their great victory over all other pumps, by abolishing leakage and friction. Since which, children readily raise water above 100 feet.

These unapproachable machines are easily repaired, and frequently do not vary in effect for many years.

Cases sufficient:—Tombland 30 feet and Bank Plain 60 feet public fountain pumps want new connectors about once in two years. Wymondham station fountain pump lifts 40 feet, once in 2¼ years. Mansion-house, St. Stephen's, fountain pump, lifts 80 feet; and continues in full effect after seven years' constant work. Norwich Bethel fountain pump, 100 feet long, the first and second connectors lasted 14 years; longer lifts, similar results.

Press and slide a wet finger upon smooth wood or metal and it will show the enormous friction of common pumps, which are publicly abandoned, and fountain pumps adopted with extraordinary advantage.

The London admirals were sadly blinded, after proving that four men with fountain pumps could raise a ton of water 25 feet high in a minute, not to know that their best pumps could never produce such a result in 100 seconds.

The Norwich aldermen being delighted at seeing a man fill a ton water-cart in three minutes, increased their fountain pumps, having proved that, for such heavy work as watering streets and roads, fountain pumps are indispensable. Their long-friction pumps now stand abandoned.

The Norfolk magistrates upset hundreds of feet of new friction pumps, finding it was impracticable to water high turnpike-roads from deep wells, except with fountain pumps. Their men, on oath, declared the best friction pumps were only fit to water footpaths. Besides, friction pumps for long lifts soon begin to faulter (a bad fault), and seldom stand roadwork for one season without repairing; whilst fountain pumps for long lifts stand roadwork for years without the slightest diminution of effect. And where their barrels, which are never disturbed, extend even beyond 100 feet, all their work being in hand reach, are soon repaired or renewed at a few shillings' cost.

The good done cannot be told. For in preserving numbers of ships, one of them had on board 230 human beings, the whole of whom were saved by the fountain pump.

Portable Fountain Fire Engines, at twenty-five fires, saved many lives and property (in Norwich alone), worth at least 50,000*l.* sterling, exclusive of the Queen's Barracks.

I am, Sir, yours, &c.,

W. Shalders.

Fountain Pump Works, Norwich.

### THE LATE WM. REID CLANNY, ESQ., M.D.

Another man of science has been taken from us: Dr. William Reid Clanny expired at his residence, Bishopwearmouth, on Thursday, the 10th inst., at the age of 73. He was a native of the County Down, Ireland. Born of respectable parents, and one of a large family, his education was completed at the Medical Schools in Edinburgh; he served as assistant-surgeon for some time in the Royal Navy while in the Baltic and North Sea, and in the action off Copenhagen. He subsequently graduated in Edinburgh, and married there Margaret, daughter of Captain Mitchell, of the Hon. East India Company's Service. He then resided and practised for a short time in the city of Durham, and subsequently at Bishop-

wearmouth, where he has eminently practised as a physician for the long period of forty-five years.

Dr. Clanny was a Fellow of the Royal Society of Edinburgh, Member of the Royal Irish Academy, a Knight Commander of the Order of St. John of Jerusalem, Physician Extraordinary to H.R.H. the late Duke of Sussex, and Consulting Physician to the Sunderland Infirmary. His attainments were of no ordinary character; he has frequently distinguished himself in various branches of philosophy, cultivating more particularly those connected with his own profession. Many of his researches have been communicated to the leading publications of the day, and which have brought his name into repute, and gained for him the friendship of many scientific men both at home and abroad.

He was benevolent to the poor, and laboured assiduously in their cause. Situated in the midst of the coal-field, his attention was naturally drawn to the many explosions which had taken place in the mines; his scientific talent and humane feelings were, with others, early enlisted in the cause of preventing these awful calamities. In the year 1813, some philanthropic and scientific gntlemen at Sunderland formed themselves into a society for the prevention of accidents in coal mines, of which the late Sir Ralph Millbank, Bart., was president, and it was before this Society in that year that Dr. Clanny exhibited a lamp which, beyond all question, was the first attempt ever made calculated to burn safely in an explosive atmosphere.

In May, 1813, a paper was read before the Royal Society, entitled "On a Steady Light in Coal Mines, by Dr. Reid Clanny," which was soon afterwards published in the *Philosophical Transactions*—the Society of Arts in London awarded their gold medal, and the Royal Humane Society of London also presented him with their silver medal. In the latter part of 1815, Dr. Clanny had the courage to make practical experiments in upwards of 100 acres of explosive air in the Herrington Mill Pit, which were attended with perfect success. This lamp never came into general use, in consequence of its cumbrous form; he devised various modifications in a more portable shape, and up to a very late period he has been working at the production of improved lamps at a great cost of time and money. Sir Humphry Davy, in the year 1815, was invited by Dr. Gray, then rector of Bishopwearmouth, and a prominent member of the Society above-mentioned, to visit him, and Dr. Clanny met his distinguished friend, and freely communicated all his views and experiments. Sir Humphrey Davy turned his attention to the subject, and in January, 1816, the first Davy Lamp was tried at the Hepburn Colliery. Almost simultaneously was invented the lamp of the late Mr. George Stephenson, who afterwards attained eminence in his profession as a civil engineer. There is no intention in this notice to discuss the merits of the lamps of Dr. Clanny with the invention of numerous others; there can be no doubt of the *originality of conception* followed out by the *construction* of the very first safety lamp ever invented; and however the first idea may have been improved by others, his persevering industry has now so perfected the lamp in the form lately constructed by him, as to make it applicable to all the purposes of mining, whether we regard its safety, brilliancy of light, and portability of form, as to make it eclipse all those of his competitors; he is, therefore, without a rival in the originality of its conception, and is equally prominent in improving that instrument, to make it the most perfect of its kind. A few friends, headed by the Marquis of Londonderry, the largest coal-owner in the north of England, aware of these facts, lately presented him with a piece of plate, as an acknowledgment for his eminent services in the cause of humanity and science.

Peace be with the ashes of him who has conferred so great a boon on his fellow-creatures, which has contributed, without doubt, to save many a poor miner from a premature and violent death.

The remains of the worthy doctor were, on Thursday, January 17, attended to the New Cemetery, Bishopwearmouth, by the leading members of the Literary and Philosophical Society (of which he may be said to be the founder, and was one of its vice-presidents), by a numerous body of Freemasons, and by a large concourse of the principal persons in the town and neighbourhood, all anxious to pay this last tribute of respect to the memory of one endeared to them by time and goodness of heart.—*Mining Journal.*

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JANUARY 31, 1850.

John Holt, Todmorden, Lancaster, manager of the Waterside Works. *For improvements in machinery or apparatus for preparing cotton and other fibrous substances, parts of which improvements are applicable to machinery used in weighing*. Patent dated July 24, 1849.

The patentee describes and claims,

1. An arrangement and construction of apparatus for weighing cotton, &c., which consists of an endless flexible band which conveys the cotton as it is delivered from the opening machine to a pair of rollers, which, in turn deliver it to a receptacle supported on a balance frame in such manner, that when it has been filled with the determined weight of cotton, it shall descend, and through the intervention of a system of levers and suitable gearing, throw the roller, carrying the endless band, out of gear with one of the delivery rollers, whence it derives its rotary motion; and, at the same time, arrest further revolution thereof, and, consequently, of the band, so as to cut off the supply to the receptacle from which the weighed cotton is removed to the "blowers" by an attendant, who afterwards sets the band in motion by means of a treadle.

2. Instead of employing attendants to remove the weighed portions of cotton from the receptacle to the blowers, they may be made to fall, after being weighed, into a hopper, which deposits them in heaps upon an endless band, whereby they are carried to the different blowers, so as to enable the attendants thereon to feed them regularly and easily.

3. Giving a circular or vibrating motion to the cams, in order that the slivers may be deposited therein more uniformly than has hitherto been customary.

4. The application of a curved plate to one of the lap rollers, which is made to press against the under side of the fleece to give it a smooth surface, and thereby render the lap less liable to adhere together when unwound than at present. The curved plate is supported in a slot, in order that the degree of pressure which it exerts may be varied as required.

5. The application of a straight edge or ruler to the lap as it passes over the "taking-in" roller to the "licker-in" roller, which supplies it to the carding cylinder, in order that the supply may be uniform.

6. An arrangement and construction of weighing machine which is applicable to the weighing of fluids or solids in a running state, and consists in a flexible tube to convey the substance from the source of supply to the sack, or other receptacle, upon the weighing platform. The flexible tube passes over an inclined plank, and underneath a valve or presser, which is connected to the weighing platform in such manner that it shall cause the presser to close the flexible tube, and thereby cut off the supply when the determined weight of substance has arrived in the sack.

ALEXANDER FERRIER ROSE, Greenvale-place, Glasgow, gentleman. *For a certain improvement or improvements in the process or operation of printing, and in the machinery or apparatus employed therein.* Patent dated July 24, 1849.

The improvements sought to be secured under this patent refer to a system of printing from types arranged around the periphery of a horizontal cylinder, which is supported between two horizontal printing cylinders that are supported in spring bearings, to allow of their adjusting themselves to the irregularities of the type cylinder. On each side of this last, between the top and bottom printing cylinders, are two ink fountains, with their delivery and inking rollers A second machine, exactly similar to the preceding, is employed, in order that the type upon the cylinder of the first machine may print the reverse of the sheet of paper, while that upon the cylinder of the second machine may print the obverse. The paper is used in a continuous web, and passed between the type cylinder and top printing cylinder of the first machine, whereby it will be printed on one side, after which it passes over a reversing roller and between the bottom printing cylinder and the type cylinder of the second machine, whereby the other side will be printed. A second web is printed in a similar manner, by being passed under and over the cylinders not used for the first web. The webs are divided, as they are delivered from the printing machines, by a cutting apparatus. A suitable space is left between any two of the columns of each type cylinder, to form the margin, while a second space is provided in similar manner to allow for the folding of the paper. To ensure registering of the two impressions, two elastic endless bands are adapted to the ends of each type cylinder, which come in contact with the webs of paper, and are arranged so as to allow of their being stretched, and their thickness consequently increased or diminished, whereby the diameters of the cylinders will be varied, and the delivery of the webs regulated accordingly. Or, instead of the preceding arrangement, bars, placed between the columns of type, may be made to move to or from the centres of the cylinders, and thereby produce a like effect—namely, the variation in the diameters of the cylinders. The types are retained in position by being made of a tapering form, and placed in galleys with curved backs, and secured by wedge-shaped rules. Or, the type cylinder may be made in the shape of a regular polygon, and the type held therein by wedge-shaped rules. The ends of the cylinder are made moveable, to allow of any one of the columns of type being taken out when required.

*Specification Due, but not Enrolled.*

JOSEPH WOODS, Barge-yard Chambers, Bucklersbury. *For improvements in bleaching certain organic substances, and in the manufacture of certain products therefrom.* (A communication.) Patent dated July 24, 1849.

## RECENT AMERICAN PATENTS.

(Selected from the Report of Mr. Keller, in the *Franklin Journal.*)

FOR A MACHINE FOR CUTTING TEETH FOR BEVELED GEAR. *George H. Corliss.*

The patentee says—"The first part of my invention consists in the use of a reciprocating cutter, governed by a guide-bar, on which the cutter carriage slides, and which has its axes of vibration, to adapt the cutter to the required depth of cogs, at the apex of a cone corresponding with the bevel of the wheel to be cut, whether such axes be fixed or adjustable to wheels of different sizes, that all the cuts may be in the direction of the radii.

"The second part of my invention consists in combining the guide-bar, on which the cutter carriage runs, with a secondary frame, hinged to the main frame, outside of the circle of the largest wheel intended to be cut in the machine, that the axis of vibration of the guide-bar may be elevated or depressed to adapt the machine to different bevels, and that the main driving shaft, which communicates motion to the operative parts of the machinery placed at the hinged end of the said frame, may be in the line of the axis of vibration of the said frame, that the vibration thereof may not change the relative position of the driving shaft, and the parts receiving motion therefrom.

"The third part of my invention consists in combining with the guide-bar a guide-plate, against which it bears by means of a weight, spring, or the equivalent thereof, so that, as the guide-bar descends to give the proper depth to the cogs, the said guide-bar shall follow the curve of the guide, and thus determine the form of the face of the cogs.

"And the last part of my invention consists in making that part of the rear end of the guide-bar, which rests against the guide, moveable, so as to have an endwise motion in or on the said bar, in the direction of its length, the said moveable part or stem being beveled back where it rests against the guide, and so connected, either with the guide-bar or some other part of the machinery, that, at the time of the cutting motion, it will move forward, that its bevel surface may be brought in contact with the guide, and give a lateral motion to the guide-bar, to relieve the cutter from the surface of the cog that is being cut, to admit of its moving back clear of the cog, and then, at the end of the return motion, a reversed motion, to bring the cutter in the proper line for cutting."

*Claims.*—"What I claim as my invention is, 1st, the method of cutting the cogs of beveled wheels by means of a reciprocating cutter that moves in or on a slide (or slides), that vibrates on an axis that coincides, or nearly so, with the apex of a cone representing the bevel of the wheel to be cut, by which vibration the depth of cut is determined; and this I claim irrespectively of the adjustment of the axis of vibration.

"2nd. I claim the guide-bar (or its equivalent) on which the cutter carriage runs, and having its axis of vibration for the depth of cut as above described, when combined with a secondary frame, jointed to the main frame at some point outside of the circumference of the wheel to be cut, that the machinery may be adapted to the cutting of cogs on various bevels.

"3rd. I claim, in combination with the guide-bar, having an universal joint, or the equivalent thereof, and operated as described, in combination with the guide-plate, to guide the cutter and determine the form of the face of the cogs.

"And, lastly, I claim making that part of the guide-bar which rests against the guide-plate, to determine the form of the face of the cogs, separated from, and moveable on, the guide-bar, and properly beveled to relieve and clear the cutter for its back movement."

FOR AN IMPROVEMENT IN CUT-OFF AND WORKING THE VALVES OF STEAM ENGINES. *George H. Corliss.*

The patentee says—"The object of the first part of my invention consists in supporting the shaft of the working beam on two vertical standards, that are erected on two horizontal beams secured and resting at the ends on the bed, the upper end of the two standards being connected to, and braced with, the ends of the horizontal beams by means of diagonal tension screw braces.

"The second part of my invention consists in communicating motion to the two valves from one rock shaft, by connecting each valve with a separate arm or crank-wrist of the rocker, the two arms making such an angle with each other, that the point of connection of the closed valves shall vibrate near the dead point, while the other, which is being opened and closed, is moving along that part of its circuit which shall give the greatest longitudinal motion.

"The third part of my invention relates to the method of regulating the cut-off of the steam in the main slide valves, and consists in effecting this by means of the governor which operates cams, so that, when the velocity of the engine is too great, these cams shall be moved by the centrifugal action of the regulator, that a catch on the valve rods may the sooner come in contact with them, to liberate the valves and admit of their being closed by the force of springs or weights, and thus cut off the steam in proportion to the velocity of the engine."

*Claim.*—"What I claim as my invention, is, 1st., the method of operating the slide valves of steam engines, by connecting the valves that govern the ports at opposite ends of the cylinder, with separate arms of the rock shaft, or the mechanical equivalents thereof, so that, from the motion thereof, the valve that keeps it port or ports closed, shall move over a less space while its port (or ports) is closed, than the one that is opening its port or ports, and *vice versâ*, while at the same time the two arms by which they are operated have the same range of motion, whereby I am enabled to save much of the power heretofore required to work the slide valves of steam engines, and by which, also, I am enabled to give a greater range of motion to the valves at the periods of opening and closing the ports, to facilitate the induction and eduction of steam. And lastly, I claim the method of regulating the motion of steam engines, by means of the centrifugal regulator by combining the said regulator with the catches that liberate the steam valves, by means of movable cams or stops, as described."

For an Improvement in Drying Grain. *Henry Quinn.*

The patentee says,—"The object of my invention is to reduce the cost of the apparatus and its liability to derangement, and, at the same time, to dry the grain with a reduced consumption of fuel, all of which I effect by causing the grain to descend from a hopper, over and down a heated inclined plane to a stationary drying pan, over which it is moved slowly by a rake."

*Claim.*—"What I claim as my invention, is the method of drying grain in an open stationary pan, having the fire and draft below it, with the rake above, for stirring the grain and causing it to pass from the feeder to the delivery, as described, whereby the moisture in the grain is more readily evaporated and liberated, and the apparatus constructed at less cost, and with less liability to derangement, than by any other plan before known, when this is combined with the feede heated by a hot air chamber, whereby the grain is gradually heated in the feeder, to draw out the moisture, before it is exposed to a higher temperature in the pan to be evaporated."

For an Improvement in Draining and Blanching Sugars. *John Spangenberg.*

*Claim.*—"What I claim as my invention, is the method of bleaching and draining brown sugars on the plantation, as herein set forth: that is to say, blanching the sugar by a solution of molasses and water, both being in the cold state, and the operation being performed in the hogshead destined for the transportation of the sugar to market, thereby increasing the value of the sugar without a corresponding increase of expense.

For an Improvement in Processes for Burnishing Metals. *Edward Satterlee.*

The patentee says.—"The nature of my invention consits in covering the surface of the metal or stone to be gilded, with a coating which possesses the properties of adhering firmly thereto, while it readily receives, and strongly retains, the gilder's materials or preparations, and possesses all the firmness requisite to permit the free use of the burnishing tools."

"*Claim.*—"What I claim as my invention, is the mode herein described, of preparing surfaces of cast or wrought iron, or other metals, and stone, so that they may be gilded or silvered in the same manner as wood, and burnished with equal facility, viz., by applying thereto the preparations of shellac and yellow ochre, or other similar and suitable earthy or mineral substance."

For an Improvement in the Clarification of Cane Juices. *John Spangenberg.*

The patentee says,—"The nature of my invention, and the great advantage it has over the old methods are as follows:—In the first place, it consists in having a greater number of juice-boxes, or otherwise, a number of boxes containing a greater quantity of juice, so that the juice may have more time to deposit its impurities and extraneous matter. Secondly, that, by thus having the juice clarified, or its impurities deposited in the several boxes it is drawn into the 'grand,' the operation of making the sugar is commenced in the kettles with a hot clarified juice. Thirdly, I use the escape steam for clarifying, although the steam direct from the boiler may be used.

*Claim.*—"What I claim as my invention and discovery, is, 1st, the direct application of steam, by injection, to the sugar cane juice, whilst in the vats, and before being tranferred to the 'grand,' for the purpose

of speedily heating, clarifying, defecating, purifying, and freeing the juice of the feculent and other extraneous, injurious and impure matter, as set forth."

For a Machine for Sewing Cloth of all kinds with a Running Stitch. *Benjamin W. Bean.*

The patentee says,—"My invention consists of a combination of gear wheels and a needle, so applied together, and arranged with respect to each other, that the gear wheels, when they are revolved and cloth is passed between them, shall make or form what I term the doubles, or the bends, corrugations, or foldings of the edges of the cloth, necessary for the passage of the needle through it, in order to the performance of the sewing of the running stitch."

*Claim.*—"What I claim as my invention, is the combination of a straight or curved needle and two or more gear wheels, for forming the doubles or corrugations of the cloth, the whole being made to operate essentially as specified. And, in combination therewith, I claim one or more cogged wheels, applied as specified, and for the purpose of advancing the doubles of the cloth along the needle as above explained.

"I also claim the mode of preventing either retrogradation or any improper movement of the needle, viz., by making it with a crook or bend, and placing against said bend one, two, or more wheels, as described."

For an Improvement in Preparing Wool and Cotton for Carding. *George L. Mason.*

The patentee says,—"The nature of my invention consists in making the fibres of wool (or other fibrous material) sufficiently soft, pliable, and yielding, for passing through the operations of carding and spinning, by thoroughly penetrating each fibre thereof with steam, just previous to, and during the operations of carding and spinning, by which I am enabled to dispense with the use of oil for softening the fibres of wool, preparatory to performing the above-named operations upon the same."

*Claim.*—"What I claim as my invention, is the application of heat and moisture to wool by means of steam, for the purpose of rendering its fibres sufficiently soft, flexible, and pliable to pass through the operations of carding and spinning, without requiring the use of oil upon the same.

"I also claim the application of steam to cotton or other soft fibrous substance, for the purpose of giving additional softness and flexibility to their fibres during the operations of carding or spinning."

For the Employment of an Auxiliary Engine in Combination with the Condenser Pump. *John Ericsson.*

The patentee says,—"The object of my invention is to condense the steam without admixture with the condensing water, and to condense the steam that escapes from the safety valve, and also for the production of fresh water for any other use."

*Claim.*—"What I claim as my invention, is the combination of the condenser of a steam engine for the propelling of a ship or other vessel, with a pump that receives the condensing water from outside the vessel, and causes it to pass the condenser, when the said pump is operated by an auxiliary engine.

"And I also claim the double connection of the condenser; that is, with the exhaust of the propelling engine, and with the boiler, when the said condenser is combined with a pump that receives the condensing water from outside of the vessel, and is impelled by an auxiliary engine."

## WEEKLY LIST OF NEW ENGLISH PATENTS.

John Dalton, of Hillingworth, calico-printer, for certain improvements in and applicable to machinery or apparatus for bleaching, dyeing, printing, and finishing textile and other fabrics, and in the engraving of copper rollers and other metallic bodies. January 26; six months.

Edwin Heycock, of Leeds, York, merchant, for certain improvements in the finishing and dressing of woollen cloths. January 26; six months.

Thomas Richardson, of the town and county of Newcastle-upon-Tyne, chemist, for improvements in the manufacture of Epsom and other magnesian salts; also alum and sulphate of ammonia. January 26; six months.

Winceslas Le Baron de Traux de Wardin, of Liege, in the kingdom of Belgium, for certain improvements in looms for weaving linen, woollen, and cotton cloths, and in machines for preparing the yarns for such cloths before entering the loom, and in a machine for finishing gray and bleached linen cloths. January 26; six months.

Thomas Schofield, of Cowbrook, Hulme, near Manchester, Lancaster, fustian dyer and finisher, and Henry Horabin, of Royton, near Oldham, in the same county, fustian cutter, for improvements in machinery for cutting fustians and certain other fabrics to produce a piled surface. January 26; six months.

Thomas Berger, of Hackney, gentleman, for improvements in the manufacture of starch. January 26; six months.

Richard Roberts, of Manchester, engineer, for improvements in the manufacture of certain textile fabrics, in machinery for weaving plain, figured, and terry or looped fabrics, and in machinery or apparatus for cutting velvets and other fabrics. January 29; six months.

Donald Beatson, of Green-street, Stepney, Middlesex, mariner, for certain improvements in instruments for taking, measuring, and computing angles. January 29; six months.

Edward Riepe, of Finsbury-square, Middlesex, merchant, for improvements in the manufacture of steel. (Being a communication.) January 29; six months.

Joel Spiller, of Battersea, Surrey, engineer, for improvements in cleaning and grinding wheat. January 29; six months.

John Mason, of Rochdale, and Mark Smith, of Heywood, both in Lancaster, machine makers, for certain improvements in machinery or apparatus

for preparing, spinning, and weaving cotton and other textile materials, and also improvements in the method of preparing yarns or threads, and in the machinery or apparatus employed for such purposes. January 29; six months.

Francis Edward Colegrave, of Brighton, gentleman, for improvements in saddles, parts of which improvements are also applicable to the standing rigging and other furniture of ships or vessels, and to the connecting links or chains of railway carriages, and other purposes where tension combined with a certain degree of elasticity is required. January 29; six months.

James Templeton, of Glasgow, Scotland, manufacturer, for certain improvements in manufacturing figured fabrics, principally designed for the production of carpeting. January 29; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery or apparatus for making hat bodies and other similar articles. (Being a communication.) January 29; six months.

Thomas Bury, of Salford, Lancaster, silk, worsted, and piece dyer and finisher, and Nathan Ramsden, of the same place, calenderman and finisher, for certain improvements in the construction of machines for glazing, embossing, and finishing woven fabrics and paper. January 31; two months.

Albert Dummler, of Mark-lane, London, for improvements in obtaining fibres from textile plants. (Being a communication.) January 31; six months.

Etienne Joseph Hanon Valck, of the kingdom of Belgium, miller, for improvements in grinding. January 31; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Jan. 26 | 2161 | White and Grant | Glasgow | Safety-cage and disengaging catch for mine shafts. |
| ,, | 2162 | John Sherratt & Charles Pickering | Walworth | Bottle neck and stopper. |
| ,, | 2163 | John Head Hopkins and Son | Birmingham | Apparatus for heating water for baths and other vessels. |
| 28 | 2164 | Thomas Kennedy | Kilmarnock | Water-proof gun nipple. |
| ,, | 2165 | Benjamin Levy | High Holborn | Expanding vest. |
| 29 | 2166 | James Finlayson | Johnstone | Thread finishing or polishing machine. |
| ,, | 2167 | Charles Leesley | Sheffield | Back for razor blade. |

## THE GREAT EXHIBITION OF 1851.

We have received a great many communications on this affair, of most of which we shall avail ourselves in one shape or other; we have also ourselves a good deal to add to our previous remarks upon it; but there have been communications going on between a Sub-Committee of the Commissioners and the self-appointed "Executive Committee" which make it prudent to pause a little before pursuing the subject further. The "Executive Committee" hold fast by the absolute powers out of which they have cheated the Crown; but it seems probable that they will, in the end, be forced by the influence of the Court (if not by any sense of decency of their own) to submit to some very important modifications and changes. A NEW COMMISSION IS TALKED OF; and, indeed, this seems the only practicable method of extricating the concern from the extremely false position in which it has been placed by dishonesty and intrigue.

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# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1383.] SATURDAY, FEBRUARY 9, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## BAIN'S PATENT ELECTRO-CHEMICAL COPYING TELEGRAPH.

Fig. 1.

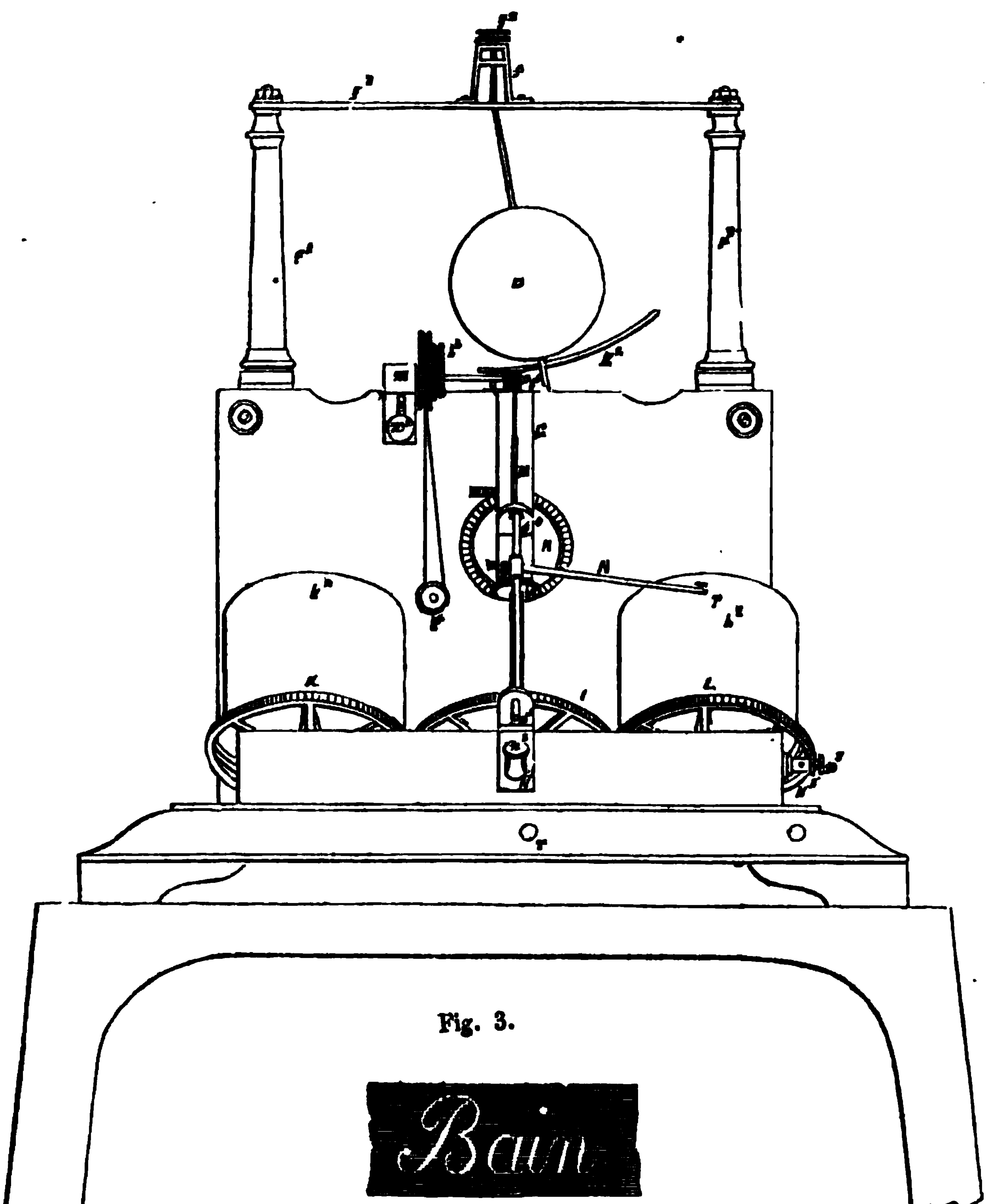




Fig. 3.

## BAIN'S PATENT ELECTRO-CHEMICAL COPYING TELEGRAPH.

Sir,—In order to place the invention of the Electric Copying Telegraph (for which a recent claimant has appeared) in its proper light before your readers and the public, I am induced to solicit a place in an early Number of your Magazine for the following narrative, to which is added a description of my Patent Copying Telegraph in its present improved state.

It was during my sojourn in the United States, in the spring of 1848, that advantage was taken of my absence by Mr. F. C. Bakewell to announce, through the medium of a paper with which he is connected (the *Spectator*), that he had effected some important improvements in electrography—so important, indeed (in his opinion), as to threaten to "supersede the Post-office!" This announcement was copied into the *Mechanics' Magazine*, No. 1289 (vol. xlviii., page 391), followed by an editorial comment on the want of novelty in Mr. Bakewell's alleged improvements.

On my return to England, being apprised of what had occurred, I addressed the following letter to the Editor of the *Spectator*:—

*Electric Telegraph-office, Lothbury, 7th June*, 1848.

Sir,—I am informed that during my recent absence in America an article appeared in the *Spectator* containing a notice of the "Copying Telegraph," which was erroneously described as the invention of Mr. Bakewell.

Permit me, Sir, as an act of justice, to inform your numerous readers that the invention is not at this time new, neither is Mr. Bakewell the inventor.

The "Copying Telegraph" was invented by me in 1842, and patented in England in the year following. I also obtained patents for this invention in Scotland, France, and Belgium. The English patent is now the property of the Electric Telegraph Company, who purchased it of me; the foreign patents I still hold. The specification of my English patent is deposited at the Enrolment-office, Chancery-lane, where it is accessible to the public at all times.

My "Copying Telegraph" is capable of transmitting the fac-simile of any communication in writing or printing, or of any other figure, including a profile of the "human face divine," so that the physiognomy of a runaway could be sent to all the outports of the kingdom in two or three minutes. The "Copying Telegraph" has not yet been put in practical operation, from the circumstance of its requiring greater accuracy in the machinery, and more perfect insulation of the wire, than has yet been attainable for great distances: but these difficulties are not insurmountable, and daily progress is making towards the necessary perfection in this department of the yet infant science of electric communication.

I remain, Sir, very respectfully, your obedient servant,

Alex. Bain.

Very soon after this date I again started for America, and Mr. Bakewell applied for, and (in consequence of my absence) obtained, a patent for his alleged invention; and, in No. 1348 of your Magazine, I find an abstract of the specification. A comparison of this document with the specifications of my previous patents, and with the machines constructed by me for the Electric Telegraph Company, would show that Mr. Bakewell has but copied my inventions, without adding a single practical improvement.

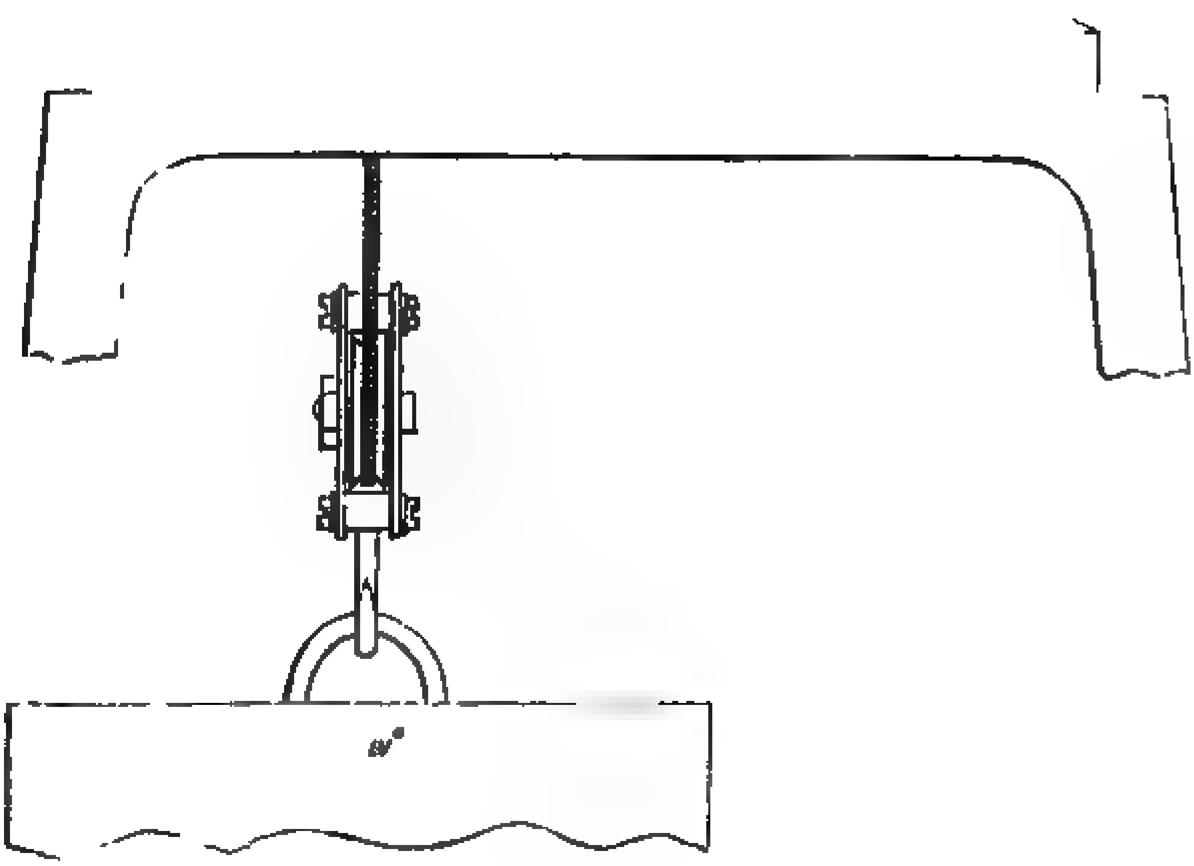
It was at the beginning of the year 1842 that I designed an Electro-Chemical Copying Telegraph, and early in 1843 took out letters patent for this and other inventions. In my specification, the principal features of this invention were ascertained and described to be:—

1stly. Telegraphic machines, made to go isochronously together, by means of electro-magnetism, brought into action by pendulums actuated by clock-work.

2ndly. The arrangement of an electro-telegraphic apparatus copying by means of a single line of wire; the intervening earth conveying the return current back to the battery.

3rdly. Composing the surface to be copied of a conducting and non-conducting substance; not confining the invention to the use of tin-foil, gilt paper, printers' types, or other metallic substance; but stating most distinctly that *any surface* composed of *conducting* and *non-conducting* materials might be used for this purpose.

Fig. 2.



4thly. The copy was received at distant places upon chemically-prepared paper.

Fig. 1 is a front, and fig. 2 a side elevation of my improved copying telegraph. A is a barrel or drum, upon which is wound, by means of the winding spindle W, a cord, to which is attached a weight $W^2$, for giving motion to the train of wheels. On one end of the drum A is a toothed wheel $a^2$, which takes into and drives a pinion $b^3$, on the the axle of the wheel $B^3$, which works into a pinion $c^3$ on the axle of the wheel $C^3$. The wheel $C^3$ drives a pinion $d^3$ on the axle of a bevil wheel $d^3$. E is a vertical shaft supported on suitable bearings, having at its lower end a bevil wheel $e$ gearing into the bevil wheel $d^3$, and at its upper end a projecting curved arm $E^2$. $F^2$ $F^2$ are pillars supporting a cross rail $F^3$, upon which is raised a bracket $f$, from the centre of which, and impinging against the curved arm $E^2$, hangs a rod, on which is placed a revolving pendulum P, supported by a flexible cord or chain from the lower end of the screw $g^2$, by turning of which the pendulum P can be raised or lowered, and the speed of the instrument controlled at pleasure. The axle of the third wheel $c^3$ is prolonged through the front plate of the instrument, and supported by a bracket G, within which it carries a bevil wheel H, working into a smaller wheel $h^2$ on the upper end of an inclined spindle, at the lower end of which is a large toothed wheel, I, taking into two similar toothed wheels, K and L, placed one on each side thereof. Upon each of the wheels K, L, there is a metal cylinder $k^2$ $l^2$, removable at pleasure. Upon the axle of the wheel $B^3$, which also projects through the front plate of the instrument, there is a small pulley $b^4$, from which a band is led up round a grooved pulley $b^5$; the pulley $b^5$ has a hollow axle turning upon a pin supported in the solid bearing $m$ of a sliding bracket $m^2$. At the opposite end of this hollow axle there is a smaller pulley $b^6$, turning with the axle in one direction by means of a pall and ratchet. One end of a silk cord is attached to, and wound upon the pulley $b^6$, by turning round the milled edge thereof, the other end of the cord being fastened to the top of a steel rod M, the upper end of which slides freely through a hole in a plate of ivory or other non-conducting surface affixed to the bracket $d^4$; the lower end of the rod M slides through an aperture in the metal bracket $d^5$. The steel rod M carries a projecting arm N, adjustable thereon by the set screw $n$, and furnished at its outer extremity with a binding screw $p$, for holding a fine wire or needle. The bar N can be turned over so as to bring the said needle in contact with either of the cylinders $k^2$ $l^2$, as may be required. $N^2$ is a brass pillar with a hole and binding screw, for the reception of a wire conveying an electric current, which pillar is in metallic contact with the bracket $d$, the rod M, and arm N $p$, but is not in contact with any other part of the apparatus. $N^3$ is a similar brass pillar in direct metallic contact with the wheels K and L, and the metal cylinders $k^2$ $l^2$. An electric current, therefore, can only get from $N^2$ to $N^3$ by passing up the rod M, along the bar N, and through the needle to one of the cylinders $k^2$ $l^2$. Any non-conducting substance, therefore, interposed between the needle in the arm N and the cylinders, cuts off the communication and prevents electricity from passing; and by thus interrupting the flow of an electric current the apparatus becomes available for copying any description of work or figure. The motion given to the train of wheels by the weight $W^2$ is controlled and rendered uniform by the revolving pendulum P, but to obtain an isochronous motion so necessary in corresponding instruments, an escapement of a novel description is employed, as shown in fig. 2. The axle of the bevil wheel $d^3$ is continued through the back frame of the instrument, and carries an arm S, to one end of which is affixed a curved steel spring $s$; the inner end of the spring is connected by a short thread to an independent axle T, which carries a snail-shaped scape wheel $t$, which revolves between, and alternately engages with two pallets vibrating upon an axis V, and connected by a crutch $v$, with a vertical pendulum $P^2$. The length of this pendulum is regulated by an upper and a lower screw, as shown, so that whenever the revolving pendulum has any tendency to deviate from the prescribed rate of going, that tendency is immediately checked by the escapement, and perfectly isochronous motion thereby insured. By this means the use of *electro-magnets*, as regulators, is entirely dispensed with; but "Mr. Bakewell's Copying Telegraph" is still encumbered with them, as was my first, patented in 1843. The instrument above described, is both *transmitting* and *receiving*; when used for transmitting, the matter to be

copied may be written upon tin foil (or on paper coated with Dutch metal), with resinous varnish, or other non-conducting material—or, what is better, marks may be made by removing the metal from the surface, which may be readily done by moistening the back of the paper, and then writing on the metal surface with a blunt style or point. The communication thus prepared is placed upon one of the cylinders $k^2 l^2$, and a cylinder of the corresponding instrument at the receiving station is covered with chemically-prepared paper. An electric current being generated by a battery at the transmitting station, is passed through the instrument there and conveyed by a single main wire to the corresponding instruments at the receiving station or stations, from whence it returns back through the earth to the battery. As the cylinders $k^2 l^2$ rotate, the arm N $p$ will gradually descend by the unwinding of the cord off the pulley $b^6$, the needle tracing a continuous spiral line from the top to the bottom of the cylinders, which becomes a permanent mark upon the chemically-prepared paper at the receiving station, broken at intervals corresponding to the marks made with the non-conducting material on the metalised paper. This will be at once understood on reference to fig. 3, where a copy of the name BAIN is shown as produced by the interrupted flow of the electric current. But the converse method may be employed, that is to say, the writing may be made with a *conducting* material upon a *non-conducting* surface, when the marks composing the received communication will be represented by dots and lines upon a plain ground. When the surface to be copied consists of moveable pieces, such as types for instance, flat surfaces are then employed in lieu of the cylinders.

The similarity of many of the features of this apparatus to that described in Mr. Bakewell's specification, at page 545 of your 50th volume, will be evident; the fact is, that there is not a single feature, either electrical, chemical, or mechanical, in Mr. Bakewell's plan, that is not embodied in my patents of 1843 and 1846, and in the machines then made, which are now in the possession of the Electric Telegraph Company, having been purchased by them long before Mr. Bakewell's plan was even in *embryo*.

Your readers may ask, how Mr. Bakewell became so intimately acquainted with my inventions? In explanation, I beg to observe that Mr. Bakewell having been for some time connected with the public press, had at various times written notices of my Electric Telegraphy, Electric Clocks, and other inventions, and was always admitted to my confidence. In 1847, whilst I was busily engaged in constructing numerous electro-chemical telegraphs, and other machines for the Electric Telegraph Company, Mr. Bakewell was a constant visitor at my workshops, and had the nature and progress of the works in hand fully explained to him. I also proposed to employ Mr. Bakewell to prepare for publication a full description of my various electrical inventions, and therefore not only showed him the work actually in progress, but also unreservedly disclosed to him my views and intentions respecting further contemplated improvements. Having possessed himself of all the information he could collect, he raised some difficulty about the proposed publication—stated that *he*, too, had improvements, but without disclosing their nature, and eventually discontinued his visits. Very soon after I quitted England, "Mr. Bakewell's Copying Telegraph" was pompously announced!

I remain, Sir, yours very truly,
ALEX. BAIN.

Hammersmith, February 1, 1850.

## REPORT OF THE ROYAL COMMISSIONERS APPOINTED TO INQUIRE INTO THE APPLICATION OF IRON TO RAILWAY STRUCTURES.

From the information supplied to us, it appears that the proportions and forms at present employed for iron structures, have been generally derived from numerous and careful experiments, made by subjecting bars of wrought or cast iron of different forms to the action of weights, and thence determining by theory and calculation such principles and rules as would enable these results to be extended and applied to such larger structures and loads as are required in practice. But the experiments were made by dead pressure, and only apply therefore to the action of weights at rest.—On the con-

trary, from the nature of the railway system, the structures employed therein are necessarily exposed to concussions, vibrations, torsions, and momentary pressures of enormous magnitude, produced by the rapid and repeated passage of heavy trains.

These disturbing causes, in smaller degree, have always occurred in structures connected with mill-work or other mechanism. But the effects upon their stability have not been found greater than could be met by increasing the dimensions of the parts without especially inquiring into the exact principles upon which such increase should be made. Thus, we are informed that the dimensions of cast-iron girders, intended for sustaining stationary loads, such as water-tanks and floors, are usually so proportioned that their breaking-weight shall be three times as great as the load they are expected to carry, or in some cases four or five times as great. But when the girders are intended for railway bridges, and therefore subject to much concussion and vibration, greater strength is given to them by altering the above proportions, and making the breaking-weight from six to ten times as great as the load, according to the practice of different engineers. On the other hand, some consider that one-third of the breaking-weight is as safe a load in the latter case as in the former.

As it soon appeared, in the course of our inquiry, that the effects of heavy bodies moving with great velocity upon structures had never been made the subject of direct scientific investigation, as it also appeared that in the opinion of practical and scientific engineers such an inquiry was highly desirable, our attention was early directed to the devising of experiments for the purpose of elucidating this matter.

The questions to be examined may be arranged under two heads, namely—

1. Whether the substance of metal which has been exposed for a long period to percussions and vibrations, undergoes any change in the arrangement of its particles, by which it becomes weakened?

2. What are the mechanical effects of percussions, and of the passage of heavy bodies in deflecting and fracturing the bars and beams upon which they are made to act?

A great difference of opinion exists among practical men with respect to the first of these questions. Many curious facts have been elicited by us in evidence, which show that pieces of wrought-iron which have been exposed to vibration, such as the axles of railway carriages, the chains of cranes, &c., employed in raising heavy weights, frequently break after long use, and exhibit a peculiar crystalline fracture and loss of tenacity, which is considered by some engineers to be the result of a gradual change produced in the internal structure of the metal by the vibrations. In confirmation of this, various facts are adduced, as, for instance, that if a piece of good fibrous iron have the thread of a screw cut upon one end of it by the usual process of tapping, which is always accompanied by much vibratory action, and if the bar be then broken across, it will be found that the tapped part is a good deal more crystalline than the other portion of the bar. Others contend that this peculiar structure is the result of an original fault in the process of manufacture, and deny this effect of vibration altogether, whilst some allege that the crystalline structure can be imparted to fibrous iron in various ways, as by repeatedly heating a bar red hot, and plunging it into cold water, or by continually hammering it, when cold, for half an hour or more.

Mr. Brunel, however, thinks the various appearances of the fracture depend much upon the mode in which the iron is broken. The same piece of iron may be made to exhibit a fibrous fracture when broken by a slow heavy blow, and a crystalline fracture when broken by a sharp short blow. Temperature alone has also a decided effect upon the fracture; iron broken in a cold state shows a more crystalline fracture than the same iron warmed a little.

The same effects are by some supposed to be extended to cast iron.

We have endeavoured to examine this question experimentally in various ways.

A bar of cast iron, 3 inches square, was placed on supports about 14 feet asunder. A heavy ball was suspended by a wire 18 feet long, from the roof, so as to touch the centre of the side of the bar. By drawing this ball out of the vertical position at right angles to the length of the bar in the manner of a pendulum to any required distance, and suddenly releasing it, it could be made to strike a horizontal blow upon the bar, the magnitude of which could be adjusted at pleasure either by varying the size of the ball or the distance from which it was released. Various bars (some of smaller size than the above) were subjected by means of this apparatus to successions of blows, numbering in most cases as many as 4,000. The magnitude of the blow in each set of experiments being made greater or smaller, as occasion required. The general result obtained was, that when the blow was powerful enough to bend the bars through one-half of their ultimate deflection (that is to say, the deflection which corresponds to their fracture by dead pressure), no bar was able to stand 4000 of such blows in succession; but all the bars (when sound) resisted the

effects of 4000 blows, each bending them through one-third of their ultimate deflection.

Other cast-iron bars, of similar dimensions, were subjected to the action of a revolving cam, driven by a steam-engine. By this they were quietly depressed in the centre, and allowed to restore themselves, the process being continued to the extent even in some cases of 100,000 successive periodic depressions for each bar, and at the rate of about four per minute. Another contrivance was tried by which the whole bar was also, during the depression, thrown into a violent tremor. The results of these experiments were, that when the depression was equal to one-third of the ultimate deflection, the bars were not weakened. This was ascertained by breaking them in the usual manner with stationary loads in the centre. When, however, the depressions produced by the machine were made equal to one-half of the ultimate deflection, the bars were actually broken by less than 900 depressions. This result corresponds with and confirms the former.

By other machinery a weight equal to one-half of the breaking weight was slowly and continually dragged backwards and forwards from one end to the other of a bar of similar dimensions to the above. A sound bar was not apparently weakened by 96,000 transits of the weight.

It may, on the whole, therefore, be said, that as far as the effects of reiterated flexure are concerned, cast-iron beams should be so proportioned as scarcely to suffer a deflection of one-third of their ultimate deflection. And as it will presently appear, that the deflection produced by a given load, if laid on the beam at rest, is liable to be considerably increased by the effect of percussion, as well as by motion imparted to the load, it follows, that to allow the greatest load to be one-sixth of the breaking weight is hardly a sufficient limit for safety, even upon the supposition that the beam is perfectly sound.

In wrought-iron bars no very perceptible effect was produced by 10,000 successive deflections by means of a revolving cam, each deflection being due to half the weight which, when applied statically, produced a large permanent flexure.

Under the second head, namely, the inquiry into the mechanical effects of percussions and moving weights, a great number of experiments have been made to illustrate the impact of heavy bodies on beams. From these it appears that bars of cast iron of the same length and weight struck horizontally by the same ball (by means of the apparatus above described for long-continued impact), offer the same resistance to impact whatever be the form of their transverse section, provided the sectional area be the same. Thus a bar, $6 \times 1\frac{1}{2}$ inches in section, placed on supports about 14 feet asunder, required the same magnitude of blow to break it in the middle, whether it was struck on the broad side or the narrow one, and similar blows were required to break a bar of the same length, the section of which was a square of 3 inches, and therefore of the same sectional area and weight as the first.

Another course of experiments tried with the same apparatus showed, amongst other results, that the deflections of wrought-iron bars produced by the striking ball were nearly as the velocity of impact. The deflections in cast iron are greater than in proportion to the velocity.

A set of experiments was undertaken to obtain the effects of additional loads spread uniformly over a beam, in increasing its power of bearing impacts from the same ball falling perpendicularly upon it. It was found that beams of cast iron, loaded to a certain degree with weights spread over their whole length, and so attached to them as not to prevent the flexure of the bar, resisted greater impacts from the same body falling on them than when the beams were unloaded, in the ratio of two to one. The bars in this case were struck in the middle by the same ball falling vertically, through different heights, and the deflections were nearly as the velocity of impact.

We have also carried on a series of experiments to compare the mechanical effect produced by weights passing with more or less velocity over bridges, with their effect when placed at rest upon them. For this purpose, amongst other methods, an apparatus was constructed, by means of which a car loaded at pleasure with various weights was allowed to run down an inclined plane; the iron bars which were the subject of the experiment were fixed horizontally at the bottom of the plane, in such a manner that the loaded car would pass over them with the velocity acquired in its descent. Thus the effects of giving different velocities to the loaded car, in depressing or fracturing the bars, could be observed and compared with the effects of the same loads placed at rest upon the bar.

This apparatus was on a sufficiently large scale to give a practical value to the results: the upper end of the inclined plane was nearly 40 feet above the horizontal portion, and a pair of rails, 3 feet asunder, were laid along its whole length for the guidance of the car, which was capable of being loaded to about two tons; the trial bars, 9 feet in length, were laid in continuation of this

railway at the horizontal part, and the inclined and horizontal portions of the railway were connected by a gentle curve. Contrivances were adapted to the trial bars, by means of which the deflections produced by the passage of the loaded car were registered; the velocity given to the car was also measured, but that velocity was, of course, limited by the height of the plane, and the greatest that could be obtained was 43 feet per second, or about 30 miles per hour.

A great number of experiments were tried with this apparatus, for the purpose of comparing the effects of different loads and velocities upon bars of various dimensions, and the general result obtained was that the deflection produced by a load passing along the bar was greater than that which was produced by placing the same load at rest upon the middle of the bar, and that this deflection was increased when the velocity was increased. Thus, for example, when the carriage loaded to 1120 lbs. was placed at rest upon a pair of cast-iron bars, 9 feet long, 4 inches broad, and 1¼ inch deep, it produced a deflection of six-tenths of an inch; but when the carriage was caused to pass over the bars at the rate of ten miles an hour, the deflection was increased to eight-tenths, and went on increasing as the velocity was increased, so that at 30 miles per hour the deflection became 1½ inch; that is, more than double the statical deflection.

Since the velocity so greatly increases the effect of a given load in deflecting the bars, it follows that a much less load will break the bar when it passes over it than when it is placed at rest upon it, and, accordingly, in the example above selected, a weight of 4150 lbs. is required to break the bars if applied at rest upon their centres; but a weight of 1778 lbs. is sufficient to produce fracture if passed over them at the rate of 30 miles an hour.

It also appeared that when motion was given to the load, the points of greatest deflection, and, still more, of the greatest strains, did not remain in the centre of the bars, but were removed nearer to the remote extremity of the bar. The bars, when broken by a travelling load, were always fractured at points beyond their centres, and often broken into four or five pieces, thus indicating the great and unusual strains they had been subjected to.

We have endeavoured to discover the laws which connect these results with each other and with practice, and for this purpose a smaller and more delicate apparatus was constructed to examine the phenomena in their simplest form—namely, in the case of a single weight traversing a light elastic bar. For the weight in its passage along the bar deflects it, and thus the path or trajectory of the centre of the weight, instead of being a horizontal straight line as it would be if the bar were perfectly rigid, becomes a curve, the form of which depends upon the relation between the length, elasticity, and inertia of the bar, the magnitude of the weight, and the velocity imparted to it. If the form of this curve could be perfectly determined in all cases, the effects of travelling loads upon bars would be known; but unfortunately the problem in question is so intricate, that its complete mathematical solution appears to be beyond the present powers of analysis except in the simplest and most elementary case—namely, in which the load is so arranged as to press upon the bar with one point of contact only, or, in other words, the load is considered as a heavy moving point. In practice, on the contrary, a single four-wheeled carriage touches each rail or girder in two points, and a six-wheeled engine with its tender has five or six points in contact on each side. This greatly complicates the problem.

The above smaller apparatus is so arranged as to comply with the simple condition that the load shall press upon one point only of the bar, and is also furnished with a contrivance by which the effects of various proportions of the mass of the bar to that of the load can be examined. From the nature of the problem, it is convenient to consider, in the first place, the forms of the trajectories that are described, and the corresponding deflections of the bar, when the mass of the bar is exceedingly small compared with that of the load.

Having obtained these under different relations of the length of the bridge, its statical deflection, and the velocity of the passing load, we proceed to investigate, in addition, the effect which a greater proportional mass of the bar or bridge has upon the deflections. We have been greatly assisted in this research by a most elaborate and complete analytical investigation by George Stokes, Esq., Fellow of Pembroke College, Cambridge, undertaken at the request of one of the members of the Commission. Unfortunately, the extreme difficulty of the problem has rendered its solution unattainable excepting in the cases in which the mass of the bridge is supposed to be exceedingly small compared with that of the load, and in the opposite case in which the mass of the load is supposed to be small compared with that of the bridge. The examples that occur in practice lie between these two extremes; for in the experiments of the Commission, performed at Portsmouth, with the inclined plane already described, the weight of the load was from

three to ten times that of the bar; but this is a much greater proportion than that which occurs in bridges, partly on account of the necessity for employing in experiments very flexible bars, to render the changes of deflection sufficiently apparent, and partly on account of the great difference of length; for if bars bearing the same ratio of weight to that of the load were employed in experiment, the deflection would become so small as to be scarcely appreciable. This will readily be perceived when it is stated that in a bridge of 33 feet long, a deflection not greater than one-fourth of an inch is usually allowed, which deflection is only $\frac{1}{1440}$th part of its length; whereas in experiment it is necessary to employ deflections of two or more inches. In actual bridges of about 40 feet span, the weight of the engine and tender is very nearly the same as the weight of that half of the bridge over which it passes; and in large bridges the weight of the load is much less than that of the bridge.

Mr. Stokes has shown, that when the inertia of the bridge is supposed small, the trajectories of the load and the corresponding deflection of the bridge depend upon a certain quantity, which he terms $\beta$; this quantity varies directly as the square of the length of the bar, and inversely as the product of the central statical deflection (namely, that which would be produced by the load set at rest on the centre of the bridge), and of the square of the velocity with which the load passes over the bridge. When $\beta$ is small, the increase of deflection due to the velocity of the load becomes very great, so much so that if $\beta$ be equal to 1·3, the statical deflections are doubled, and are tripled when $\beta = 0{\cdot}8$; becoming still greater as lesser values of $\beta$ are taken. On the contrary, greater values of $\beta$ correspond to small deflections; and it has been shown by our researches, that in the cases of real bridges $\beta$ is rarely less than 14, and is commonly very much greater; and that, consequently, the greatest increase of deflection from velocity would be upon this theory never greater than one-tenth, varying from that to one-hundredth, or less. As $\beta$ varies directly as the square of the length of the bridge, it is plain that the nine-feet bars of the Portsmouth experiments will correspond to much less values of $\beta$ than the 20 and 30 feet lengths of actual bridges; while the values of $\beta$ in the former cases are still further diminished by the greater deflections necessarily employed in experiments, as above explained. It is thus shown that the enormous increase of deflection produced by velocity in the Portsmouth experiments cannot occur with real bridges, since it appears that the phenomena in question are developed to great extent when the magnitude of the structure is diminished. But these calculations are made upon the supposition that the inertia of the bridge is very small; and experiments made with the small apparatus above-mentioned have shown that while $\beta$ is less than about unity, the inertia of the bridge tends to diminish the deflection; while, on the other hand, when $\beta$ is greater than unity (including, of course, all practical cases), the inertia of the bridge tends to increase the deflections obtained upon the above supposition. Lastly, the total increase of the statical deflection, when the inertia of the bridge is taken into account, will be found much greater for short bridges than for long bridges. Supposing, for example, the mass of the travelling load and of the bridge to be nearly equal, the increase of the statical deflection at the highest velocities for bridges of 20 feet in length and of the ordinary degree of stiffness may be more than one-half; whereas, for bridges of 50 feet in length, the increase will not be greater than one-seventh, and will rapidly diminish as greater lengths are taken. But as it has been shown that the increase, *cæteris paribus*, is diminished by increasing the stiffness of the bridge, we always have it in our power to reduce its amount within safe limits. Hence, in estimating the strength of a railway bridge, this increase of the statical deflection must be taken into account, by calculating it from the greatest load which is likely to pass over the bridge, and from the highest possible velocity. It must be remembered, also, that this deflection is liable to be increased by jerks produced by the passage of the train over the joints of the rails.

We also made some experiments by means of the large apparatus, before mentioned, on curved bars, and these bore much greater weights at high velocities than straight bars; but the deflections of these bars were very great, compared with their length. In drawing attention to these experiments, we would remark that, in actual structures, where the deflections are so very small, the effect of cambering the girders, or of forming a curved pathway for the load, would be of less comparative importance, and might tend to introduce practical inconvenience.

The general impression amongst engineers appears to be at variance with the above results. They, for the most part, state their belief that the deflection caused by passing a weight at a high velocity over a girder is less than the deflection which would be produced by the same weight at rest; even when they have observed an increase, they have attributed it solely to the jerks of the engine

or train produced by passing over inequalities at the junction of the rails, or other similar causes.

For the purpose of examining this question, we have submitted two actual bridges to the test of experiment. These bridges, one of which, the Ewell Bridge, is situated upon the Croydon and Epsom line, and the other, the Godstone Bridge, upon the South Eastern line, are both constructed to carry the railway over a road. A scaffold was constructed, which rested on the road, and was, therefore, unaffected by the motion of the bridge, and a pencil was fixed to the under side of one of the girders of the bridge, so that when the latter was deflected by the weight of the engine or train, either placed at rest or passing over it, the pencil traced the extent of deflection upon a drawing-board attached to the scaffold. An engine and tender, which had been in each case liberally placed under our orders by the directors of the companies, was made to traverse the bridges at different velocities or rest upon them at pleasure. The span of the Ewell Bridge is 48 feet, and the statical deflection due to the above load rather more than one-fifth of an inch. This was slightly but decidedly increased when the engine was made to pass over the bridge; and at a velocity of about fifty miles per hour, an increase of one-seventh was observed. As it is known that the strain upon a girder is nearly proportional to the deflection, it must be inferred that in this case the velocity of the load enabled it to exercise the same pressure as if it had been increased by one-seventh, and placed at rest upon the centre of the bridge. The weight of the engine and tender was thirty-nine tons, and the velocity enabled it to exercise a pressure upon the girder equal to a weight of about forty-five tons. Similar results were obtained from the Godstone Bridge. We would take this opportunity of mentioning how much we are indebted to Mr. P. W. Barlow and to Mr. Hood for the assistance they afforded us in making these experiments.

We have also to express our obligations to the Astronomer Royal for the advantage of his presence during the above and other experiments, as well as for many valuable suggestions during the progress of the inquiry.

In addition to the above experiments, we have made many for the purpose of supplying data for completing the mechanical theory of elastic beams. If a beam be in any manner bent, its concave side will be compressed, and its convex side extended. An exact knowledge of the laws which govern its compression and extension must precede any accurate general theory of its deflections, vibrations, and ruptures.

The law which is usually assumed in mathematical investigations, and by which the longitudinal compressions and extensions, within certain limits, are assumed to be directly proportional to the forces by which they are produced, although very nearly true in some bodies, is not, perhaps, accurately true for any material.

Experiments, have, therefore, been made to determine with precision the direct longitudinal extension and compression of long bars of cast and wrought iron. The extensions were determined by attaching a bar, 50 feet in length and 1 inch square, to the roof of a lofty building, and suspending weights to its lower extremity.

The compressions were ascertained by enclosing a bar 10 feet long and 1 inch square in a groove, placed in a cast-iron frame, which allowed the bar to slide freely without friction, and yet permitted no lateral flexure. The bar was then compressed by means of a lever, loaded with various weights. Every possible precaution was taken to ensure accuracy. The following formulæ were deduced for expressing the relation between the extension and compression of a bar of cast-iron, 10 feet long and 1 inch square, and the weights producing them respectively:—

Extension, $w = 116117e - 201905e^2$.
Compression, $w = 107763d - 36318d^2$.

Where $w$ is the weight in pounds acting upon the bar, $e$ the extension and $d$ the compression in inches.

And the formulæ deduced from these, for a bar 1 inch square and of any length, are—

$$\text{For Extension,} \quad w = 13934040 \frac{e}{l} - 2907432000 \frac{e^2}{l^2}.$$

$$\text{For Compression,} \quad w = 12931560 \frac{d}{l} - 522979200 \frac{d^2}{l^2}.$$

Where $l$ is the length of the bar in inches.

These formulæ were obtained from the mean results of four kinds of cast-iron.

*(To be concluded in our next.)*

WILLIAMS'S SCREEN AND SMUT MACHINE.

[Registered under the Act for the Protection of Articles of Utility. Edward Grey Williams, of 11, Dover-street, Everton, Liverpool, Millwright, Proprietor.]

Fig. 2.

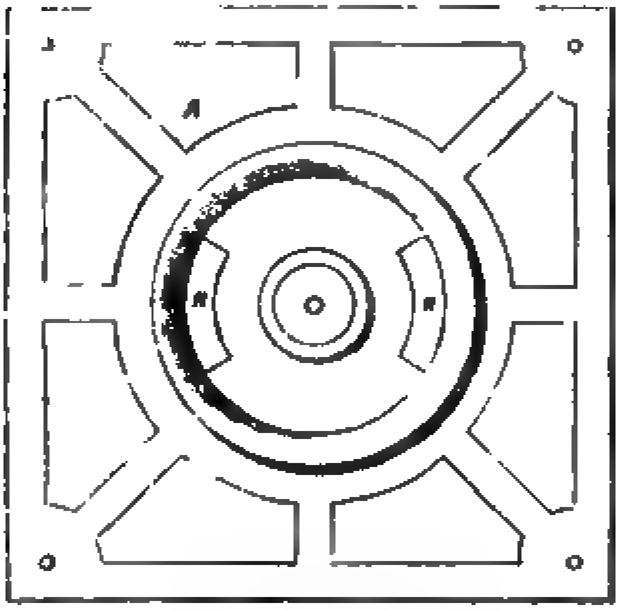


Fig. 1.

Fig. 3.

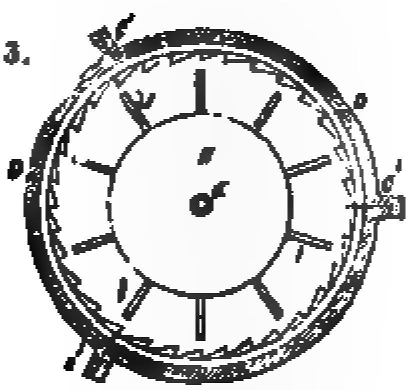


Fig. 1 is a sectional elevation of this machine. A is the under plate of the framework; a plan of which under plate is given separately in fig. 2. B is the upper plate, which is nearly similar to A. The two plates are connected together by four pillars, or rods C C. D D is a cylinder, composed of two or three sections bolted together longitudinally by the flanges C C, shown in fig. 3, which is a cross section of the cylinder on the line *a*, *b*, of fig. 1. The upper half of the cylinder is grooved lengthwise, in the manner shown in fig. 3, and the under half of it is covered with wire gauze *d d*, of about nine rows of meshes to the inch E is a spindle which rests upon a steel centre in the bridge F, affixed to the lower side of the bed-plate A. The upper end of this spindle has its bearing G, fixed to the plate B. H H is a hollow drum affixed on the spindle E; the upper half of this drum corresponding with the grooved half portion of the cylinder. D has ten beaters, I I, affixed to it, and the lower portion is furnished with six radiating vanes, K K. The grain to be cleansed is put into a hopper on the top of the spout L, and motion is communicated to the machine by a band applied to the pulley M. The grain in passing through the upper portion of the cylinder between the beaters and the grooved surface has all the smut, &c., completely disengaged from it, and during the remainder of its progress to the bottom of the cylinder the dust, &c., is driven through the wire gauze by the vanes K K, while the grain itself is discharged through the apertures N N, and may then be subjected to the action of a fan or winnowing machine (if such additional process should be found necessary). The machine may be set in an upright or in an inclined position, but works best at an angle, varying from 80° to the perpendicular line.

THE FIRST FRUIT OF THE GRAND EXHIBITION PROJECT.

Sir,—In your last number it was promised to the readers of the *Mechanics' Magazine*, that the opinions and suggestions of numerous correspondents, together with some further remarks by the Editor, on the forthcoming great national farce should shortly appear. Doubtless, they will do so all in good time, and be as racy, logical, and argumentative as were the first. But, while the storm is brewing over the heads of the council and executive—the promoters and dupes of this arrant piece of humbug—will you allow me to call attention to one of the first fruits of it which has as yet been made public. I allude to the 500*l*. offered by the Messrs. Nicoll, the advertising tailors of paletôt celebrity, to be awarded as a prize for the best made, best dyed, and most cheaply-manufactured cloth, which shall be produced at the forthcoming exhibition. The terms on which the prize is to be granted—as described in the advertisement—are, that the competitors shall enter caveats at their own expense forthwith, and within a given space of time, submit samples of their manufacture to certain competent judges, who will decide which is the best, in every respect, and best adapted for that eternal paletôt, which, in addition to being the most uncomfortable outer garment ever invented, would disfigure even the Apollo Belvidere. The manufacturer who has produced the prize specimen of cloth is to receive the 500*l*., and, as a *quid pro quo*, is to assign his patent right to Messrs. Nicoll, who will pay all expenses of the patent! Now, Sir, I apprehend that the readers of the *Mechanics' Magazine*, have a somewhat acuter perception of the value of a mode of manufacturing woollen goods superior to anything that the looms of the West Riding, Somerset, Saxony, or France have yet produced, than those noodles who so vehemently applauded the pompous announcement at the city meeting of the *quasi* generosity of Messrs. Nicoll. Why, if the maxim still holds good, that "the worth of anything is just as much as it will bring," what is to be estimated as a fair equivalent for the monopoly of manufacturing an article of general consumption, which from its superiority, to say nothing of the prestige of the prize, will command the markets of the world? The fortune which the lucky wight would realize who possessed the exclusive right to make, use, exercise, and vend it, would be colossal, to be counted not by thousands, nor even tens of thousands, but by hundreds of thousands. I need scarcely assure you, Sir, that I have no personal ill-will toward the worthy Sheriff of the City of London and his brother, and that I am no rival of theirs, seeing that I have no interest, either direct or indirect, in clothing the human form divine; nor even do I blame them for shaping to their ends the rough hewn design of the Royal President of the Society of Arts and Manufactures. They have the world before them, and are of course desirous to snip their way through it to fortune and civic honours. They have always evinced a happy disposition in following rather than leading the public taste, and now cant with the times in the present instance; and I hold that however unfair their proposition is to inventors, of which unfortunate class I am a needy member, it does them great credit, and is worthy of that ingenuity which insinuated an announcement of their wares into the third column of the *Times*, among the stolen and lost, and the enigmatical sentences addressed to all the letters of the alphabet by disconsolate fair ones, bereaved parents, and misguided youths. The council and executive have met in conclave repeatedly. The public have anxiously watched their throes of labour, and lo! Nicoll's 500*l*. prize paletôt is brought forth. I presume that this system will not be confined to Messrs. Nicoll alone, but that we shall have in addition to their prize paletôt, Jullien's prize polkas, Parr's prize pills, &c., until we are prized out of our ordinary ways of life. Such then, Sir, is one of the results of the proposal for the exhibition. And, as coming events cast their shadows before, what are we to argue will be the consequences of its realization? —fraud, deception, heart-burning and disappointment to the candidates, the promoters, and the public, which you have predicted and will see fulfilled. And I can assure you, that it will be a subject of no small gratification to one who has so long been an admirer of the *Mechanics' Magazine*, and stands indebted to it for the greater part of his acquaintance with practical science, to witness the consistency of twenty years so signally recognized; and the soundness of the views it has always advocated with respect to expositions,—which are in strict accordance with the kindest feelings of humanity, and the soundest principles of political economy,—so fully established as they will be in 1851.

From what I have said I shall doubtless incur the charge of being a cynical and disappointed man, one on whom the example of a generous heart falls as did the seed sown on stony ground; and in reply, I can only say, that being no bee to labour to

please the luscious appetites of my destroyers, or drone to fatten on the produce of others, I am content to bear the name of

GUÊPE.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 7TH, 1850.

ADAM YULE, Dundee, master mariner, and JOHN CHANTER, Lloyd's, London. *For improvements in the preparation of materials for coating ships and other vessels.* Patent dated August 1, 1849.

The object of this invention is to protect ships' bottoms, whether plain or sheathed, from marine deposits, by coating them with one or other of the following compositions:

1. 8 to 10 parts of bullock's gall, 30 lbs. of carbonate of iron or plumbago reduced to a fine powder, mixed together to form a paste, to which 4 gallons of salt water are added to bring the whole to the proper consistency. [What relation is there between parts and pounds?]

2. 30 lbs. of carbonate of iron or plumbago in powder, 3 lbs. of white arsenic, 2½ gallons of coal tar, naphtha, or spirits of turpentine, and from 12 to 14 lbs. of Stockholm tar dissolved in the above spirit.

[*Note.*—In the case of iron or zinc, it is to be first coated with a solution of caoutchouc or gutta percha before laying on either of the above compositions.]

3. 10 lbs. of carbonate of iron or plumbago in powder, and 1 lb. of white arsenic, to which Russian tallow is added, with the assistance of heat to incorporate the whole together. This composition is to be applied hot, and rubbed over with the powder dry.

No claims are made in this specification.

EUGENE ALEXANDRE DESIRÉ BOUCHER, Rue de Vinaigriers, Paris, metal merchant. *For certain improvements in the manufacture of cards.* Patent dated August 1, 1849.

To prevent the injurious effects on fibrous materials rising from the oxydation of the iron wire of which the cards for carding them are manufactured, it is proposed to coat the wire with a less oxydizable metal than iron by one or other of the following processes:

1. 5 gallons of water are heated to 86° Fahr., and 1 oz. of sulphate of copper, and ½ oz. of sulphuric acid are added to it. When cold, the iron wire is then immersed in it, and thereby coated with red copper; and in order to produce a better cohesion of the two, the coppered wire is drawn through a drawing bench. The immersing and drawing is repeated until the wire is sufficiently coated.

2. Or the wire may be coated through the agency of electrical deposition. For this purpose, it is placed in a bath consisting of five gallons of water heated to from 48° to 56° Fahr., 2½ lbs. of yellow cyanure of potassium and iron, and 4½ lbs. of carbonate of potash, and connected to the negative pole of a voltaic battery. A plate of red copper is also immersed, and connected to the wire on one side, and to the positive pole of the battery on the other. The iron wire may be coated by this process with any other suitable metal, such as tin, brass, lead, zinc, &c., by substituting a plate thereof for the one of red copper in the bath.

*Claims.*—1, Constructing cards for carding fibrous materials with iron wire, rendered inoxydizable by being coated with a metal less oxydizable than the iron.

2. The processes for obtaining the said coating, as described.

DAVID CLOVIS KNAB, Leicester-place, C. E. *For an improved apparatus for distilling fatty and oily matters.* Patent dated August 1, 1849.

This "improved apparatus" consists of a tank of iron or copper, containing a bath of melted lead, and heated by a furnace placed underneath, in which is suspended a bell, also of iron or copper, so as to allow the melted lead to rise inside a few inches above its edges. At one end, and in the upper part of the bell, there is a funnel which receives the oily or fatty matters from a reservoir, and supplies them to the surface of melted lead within the bell. The funnel is provided with a valve fixed on a vertical spindle, which carries at top a counterbalance lever and weight, and at bottom a float-ball which rests upon the surface of the melted fatty matters. The object of this arrangement is, that when the fatty matters are evaporated, and their height in the bell decreased, they may allow the float to descend, and consequently open the funnel to a fresh supply. A steam pipe is led from a boiler, and dipped into the melted lead, for the purpose of depriving, as much as practicable, the steam of its aqueous particles. It is then made to rise inside the bell, and lay along the top of the lead. This part of the pipe is perforated with numerous holes to admit steam to the fatty matters, for the purpose of expelling atmospheric air therefrom. The steam is to be used at a pressure of 24 lbs. to the square inch, and the tank is furnished with a waste pipe rising inside the bell just above the surface of lead, for the purpose of conveying away the residuum from the distillation. The end of the bell opposite to the funnel is fitted with a pipe which conveys the fatty vapours to an intermediate vessel, whence they pass to a refrigerator, leaving

behind them whatever impurities they may have carried from the bell, and which are drawn from the intermediate vessel, as occasion may require, by means of two taps. The patentee states that any refrigerator may be employed, but that he prefers one composed of a copper tank immersed in an outer vessel filled with cold water, and fitted inside with partitions attached alternately to the top and bottom thereof, but not reaching the whole distance, in order that the fatty vapours may be made to impinge against the cold surfaces alternately. The outer tank is divided into two parts, and each supplied with a separate stream of cold water. When the fatty vapours and steam have been condensed, their different specific gravities will enable the workman to separate easily the oil from the water. In the case of tallow, or other fatty matter liable to congeal when cold, it is kept in a fluid state by the introduction of steam.

*Claim.*—The apparatus, which consists of a bell placed in a bath or tank, and furnished with a funnel, and with steam and other pipes or tubes for distilling fatty or oily matters from the surface of melted lead, as described.

JOHN SHAW, Glossop, Derby, musical instrument-maker. *For certain improvements in air-guns.* Patent dated August 1, 1849.

Mr. Shaw's air-gun is constructed with the syringe or pump placed between the breech and the barrel, and fitted with an air-tight piston having a recess in the back to receive the trigger, which is acted on behind by a spring, and thereby kept in a vertical position so as to hold the piston fast against the breech end of the pump, and keep the gun at full cock. The fore part of the piston is firmly attached to a rod, the other end of which is hooked, and passes through an air-tight orifice in the fore end of the pump. Above this orifice is a second one, which opens into the barrel destined to receive the bullet. The stock is made to extend the whole length of the barrel, and has a groove cut in it, which receives the hooked end of the piston rod. The end of the groove, near the mouth of the barrel, is fitted with a stud, to which is attached an endless band of vulcanized India-rubber, the other end of which is connected by a linen band to the hooked end of the piston rod. The bottom of the barrel is slightly contracted, to prevent the bullet being rammed into the pump. A slot is cut in the under part of the groove, and a projection is cast upon the piston rod near the hook. To cock the gun, or bring the piston from the fore to the back end of the pump, the butt is placed against the thigh, and a piece of metal, having an indentation cut on the face and fitted with two curved handles, is introduced into the slot, so as to take hold of the rod between the projection cast thereon and the hook. The sportsman, or other person, then grasps the handles with both hands, draws the projection to the breech end of the groove, and thereby forces the piston down the pump until the trigger takes into the recess, so as to maintain it in that position. The vulcanized India-rubber band is extended six and a half times its original length. The bullet is next rammed down. When it is desired to discharge the gun, the trigger is pulled, the piston released, and the reactive force of the elastic spring allowed to act, whereby the air, contained in the pump, is suddenly compressed, so as to project the bullet from the barrel. The pump is, moreover, provided with an aperture (which may be closed when not required) for admitting air to the interior when the bullet has been rammed down before cocking.

*Claim.*—Compressing air in air-guns at the instant of discharge by a single stroke of a syringe or air-pump, actuated by a previously-extended or compressed spring, or other elastic means.

JULIAN EDWARD DISBROWE RODGERS, High-street, Pimlico, professor of chemistry. *For improvements in the manufacture of white lead.* Patent dated August 1, 1849.

Mr. Rodgers proposes to manufacture carbonate of lead, commonly called white lead, by suspending pieces of sheet or cast lead, bent in the form of two sides of a triangle, upon frames erected in a room, or chamber, which is capable of being darkened and rendered air-tight, or nearly so, when required. Underneath the frames are troughs, some of which are filled with a fluid capable of passing into the state of vinous fermentation spontaneously, or of doing so on the addition of yeast, and thereby evolving carbonic acid gas. The other troughs contain sour beer, vinegar, or other similar fluids, into which steam-pipes from a boiler are caused to open, so as to produce acetic acid, or pyroligneous acid and aqueous vapours. The *modus operandi* is as follows:—The pieces of lead are suspended in the frames as close together as possible without actual contact, and the chamber made air-tight, or nearly so, and maintained at a temperature of from 70° to 80° Fahr. As soon as the carbonic acid gas is evolved, the chamber is darkened, and steam admitted about three times in every twenty-four hours, to produce acetic, or pyroligneous acid and aqueous vapours. The chamber is provided with a manhole, to allow of the troughs being replenished when the fluid contents have been exhausted, which will occur at the expiration of forty-eight hours. This ope-

ration for converting metallic lead into carbonate of lead generally takes twelve days.

*Claims.*—1. The use of a chamber, or room, in the manufacture of white lead, which is capable of being made air-tight, or nearly so, when required, and into which the supply of carbonic acid gas, and acetic acid, or pyroligneous acid and aqueous vapours, may be controlled or regulated.

2. The introduction of steam into the converting chamber, either alone or combined, as described.

James Murdoch, Staple's-Inn, mechanical draughtsman. *For certain improvements in converting sea water into fresh, and in ventilating ships and other vessels; applicable also to the evaporation of liquids, and to the concentration and crystallization of syrups and saline solutions.* (A communication.) Patent dated August 1, 1849.

These "improvements" consist in the adaptation to the top of an ordinary ships' boiler which is filled with salt water, and employed to heat the contents of saucepans, &c., of a pipe, which descends into the hold, and opens into a vessel contained in an outer casing filled with cold water. This vessel is fitted with a number of vertical tubes in communication with the descending pipe, and all provided inside with a number of horizontal discs of wire gauze. It terminates at bottom in a zig-zag pipe, which passes through the side of the cold-water cistern, and opens at top underneath an exhausting fan. The upper part of the boiler is furnished with a perforated tube which admits atmospheric air. When the fan is set in motion, the air and steam generated in the boiler are drawn together down the vertical pipe, through the tubes and the wire gauze discs placed therein. The steam is condensed in its passage, and rendered pleasant to the taste by mingling intimately with the atmospheric air, which is exhausted by the fan and thereby discharged.

The ship may be ventilated through the agency of this fan by connecting a perforated pipe, placed underneath the middle deck, to its discharge. This pipe may be also connected to a second perforated lower pipe, placed on the lower deck, and connected to a vertical pipe which communicates with the atmosphere.

An apparatus similar to the one first described, with the exception of the condenser, the use of which is dispensed with, may be applied to the concentration and crystallization of syrups and saline solutions. The form of the boiler being, of course, modified so as to assume the appearance of the ordinary pan; and in some cases the bottom is made corrugated, to form continuous zig-zag channels, through which the steam circulates, for the purpose of increasing the heating surface.

*Claims.*—1. The employment of a current of air, produced by an exhausting fan, for accelerating the evaporation of salt water.

2. The application of a current of air, produced by an exhausting fan, to the distillation of alcoholic or spirituous liquids.

3. The mode of ventilating ships, in combination with the apparatus for converting salt water into fresh.

4. The employment of apparatus for the concentration and crystallization of syrups and saline solutions, having continuous zig-zag channels for the circulation of steam therein, closed, or not, and combined, or not, with the exhausting fan.

Joseph Lowe, Salford, Lancaster, surveyor. *For certain improvements in grates or grids applicable to sewers, drains, and other similar purposes.* Patent dated April 12, 1849.

The grate has hinged to it, underneath, a square box, one side of which is replaced by two vertical partitions attached to the top and bottom of it, but not reaching the whole way, so that when the box is filled with water, the two partitions in conjunction therewith will form a gas-tight joint without interfering with the flow of the surface water to the sewer or drain.

*Claim.*—The peculiar construction and arrangement of grates or grids, whereby the rise or escape of effluvium is prevented, which is effected by the formation of the gas-tight joint, as described.

Florentine Joseph De Cavaillon, Páris, chemist. *For certain improvements in obtaining carbonated (query carburetted?) hydrogen gas, and in applying the products resulting therefrom to various useful purposes.* Patent dated August 1, 1849.

The patentees remarks, that the ordinary carburetted hydrogen gas has hitherto been manufactured from coal alone; but, that he proposes to mix with the coal, in the proportion of 50 per cent., bones, suet, oleaginous seeds, spent bark, and sawdust which has been used in the purification of oils, or any fatty or oily waste. These substances are moistened with molasses or empyreumatic oil, and mixed with the coal; after which the whole is shovelled into ordinary gas retorts, and distilled in the usual way.

The resulting products are stated to be—

1. Carburetted hydrogen gas, of a highly illuminating power.
2. Animal charcoal.
3. Animal and vegetable charcoal, in powder, which may be applied to the preparation of manure.
4. Empyreumatic oil.
5. Rich ammoniacal liquors.

In order to economize the lime employed

in the purification of gas, it is proposed to employ a purifying powder, composed one half of any of the natural or artificial sulphates of lime (by preference, plaster which has been used in building), animal charcoal, vegetable charcoal, coke, river or sea sand, spent bark, sawdust, peat, or turf, sulphate and oxide of lead, all reduced to powder and wetted with dilute sulphuric acid, or acidulated water of 6° to 7° Beaumé. The gas to be purified is made to pass through perforated metal plates, or wire gauze shelves, upon which is laid moss to prevent the apertures being clogged by the refining powder which is laid thereon. The lime is laid above the powder. The quantity of lime employed is one-third, and that of the refining powder two-thirds; which last is composed of purifying substances, such as the sulphates of lime, inert substances rendered purifying, such as sawdust saturated with sulphuric acid, and inert substances, such as powdered coke. When the materials are charged with too much ammonia or sulphuretted hydrogen (which can be ascertained by causing the gas to come in contact with turmeric test paper and paper saturated with acetate of lead, which will be turned black), they are to be replaced by a fresh supply of refining powder and lime.

No claims are made in this specification.

Thomas Potts, Birmingham, manufacturer. *For improvements in apparatus used with curtains, blinds, maps, and plans.* Patent dated August 1, 1849.

The improvements specified under this patent are as follow:—

1. A piece of sheet metal, of the required length and breadth to form the tube in which the curtains are to be supported, is drawn through dies, which will have the effect of forming the tube and bending the edges back against the inside, thereby producing an opening in the direction of the length of the tube. Rollers are placed inside the tube, and are furnished with arms that project through the slit, to which the curtains are made fast.

2. Instead of making the tube of one metal, which, in case of its being of brass, would render it expensive, it is proposed to employ two sheets of metal, the outside one of brass and the inner of iron, and to draw the two at the same time through dies, as before.

3. The outside tube is made of perforated metal, or wire gauze, and lined with some differently-coloured metal or substance, by preference gutta percha, in order that the contrast of colours may show the perforations of the outer tube.

4. The tube is filled with lead, which may afterwards be melted and easily run out, and two collars cast on both ends, and sometimes one also in the centre. It is then twisted by mechanical means, the whole in one direction, or half one way and half the other, so as to form spiral turns upon it.

5. Instead of the ordinary arrangements for drawing curtains, it is proposed to employ a right and left-handed screw, on which are numerous collars, whereby the curtains are suspended, having internal projections that take into the threads of the screw. A pulley is cast on one end of the screw-rod, and a cord wound round it, whereby the rod may be made to revolve in one or the other direction, and the curtains drawn or withdrawn accordingly.

6. Or, the curtains may be attached, at regular distances, to vulcanized India-rubber bands, or metallic springs, the outer ends of which are made fast to the wall, or framing, while the near ends are furnished with cords which pass over pulleys, and allow of the curtains being drawn together. They are retained in position by the cords being made fast to studs provided for that purpose,—the reactive force of the springs serving to withdraw the curtains.

7. Or, the curtains may be supported by being connected to the centres of the links of lazy tongs which are provided with wheels running on a rail, and are extended or compressed, so as consequently to draw or withdraw the curtains, by means of cords made fast, at the centres, to the near ends of the tongs, the outer ones being made fast. By pulling one or other of the two ends of each cord, the respective legs or tongs, and consequently curtains, will be acted on accordingly.

8. Or, the curtains may be supported by rings sliding over rods, or tubes, which are made of such a form, by preference that of a pear, as not to allow of the former turning round the latter. The rings are to work in open joint tubes, as in the first instance.

9. In place of the ordinary roller for blinds, an open-joint tube is to be employed which is fitted internally with a rod passed through a hem in a piece of tape to which the blind is attached. A pulley is cast upon the tube and furnished with a cord, whereby the blind is drawn up, and the whole inclosed in an outer case.

10. A similar arrangement to the last is to be applied to blinds for greenhouses and horticultural purposes generally, with the addition of supports being attached to the end and, in some cases, to different parts of the blind which run on rails provided for that purpose.

11. Or, external blinds may be attached to two horizontal arms, hinged to two vertical rods on either side of the window, which have the rotary motion communicated to one by means of a winch handle and im-

parted to the other by means of suitable toothed gearing. The arms are respectively connected to collars, each having inside a spiral groove into which takes a stud on a bearing, which is fixed on either vertical rod, so that, as the arms are turned outwards, they will descend and carry the blind with them. The reverse action takes place when the contrary rotary motion is communicated.

12. Manufacturing racks, for window-blinds, by cutting teeth on the edges of a metallic plate and bending it into shape afterwards, as is well understood. Or, the rack may have holes, punched in the back of it, into which a stud on the back of the spring-catch takes.

13. Or, instead of the preceding method, the rack is to be constructed of a metal plate, having two guides affixed thereto, in which slides a toothed rack, actuated by means of a small pinion. The roller cord is attached to the top of the rack.

*Claims.*—1. Making tubes with openings in the direction of their lengths, and having the edges turned back, in combination with curtains, blinds, or plans.

2. Making open-joint tubes of two thicknesses of metal, in combination with curtains, blinds, or plans—the edge of the one thickness of metal being turned back over the one of the other thickness.

3. The mode of making perforated tubes, to be used with curtains, blinds, or plans, of metal, or wire gauze, and applying within them surfaces of different colours.

4. Making the threads or reeds, of straight-reeded or squared tubes, curved, or spiral.

5. The mode of opening curtains by means of a right and left-handed screw.

6. The mode of opening curtains by means of an elastic, or a metallic spring.

7. The mode of opening curtains by means of "lazy legs," or "lazy tongs."

8. The mode of opening curtains by means of rings and rods which are of such a shape as not to allow the first to turn round the last.

9. Making roller blinds, maps, or plans to roll up in open-joint tubes.

10. Applying the same arrangement and construction to blinds, or shades, for horticultural and other similar purposes.

11. The mode of supporting external window-blinds.

12 and 13. The mode of manufacturing racks for window-blinds.

Jerome André Drieu, Manchester, machinist. *For certain improvements in the manufacture of wearing apparel, and in the machinery or apparatus connected therewith.* Patent dated August 1, 1849.

These "improvements" consist, firstly, in a peculiar method of weaving cloth, by means of which it may be widened or narrowed in particular parts, for the purpose of being afterwards more readily manufactured into garments; and, secondly, in a certain mode of conveying instruction to the weaver.

1. The warp threads, instead of being wound upon a beam, as usual, are wound upon bobbins, placed at the back of the loom, and free to revolve independently of each other, and passed under a roller. The warp threads are then passed through a drag or clamp, which is composed of two parts, the under one being fixed, and having an indentation on its surface, and the upper one, which is in two parts, being hinged and fitted with a projection which takes into the indentation. A pulley is cast upon the end of each bobbin, and a weighted cord passed round it, for the purpose of keeping the warp threads at the requisite degree of tension. The moveable parts of the clamp are attached to two levers, on either side of the loom, and provided with weights, whereby they are made to press upon the warp threads. Instead of using a cloth beam, to take up the work when completed, the patentee employs a number of jaws, which hold the edge of the cloth along the front at regular intervals, and are connected by straps, capable of being lengthened or shortened at pleasure, to a roller. The operation of weaving is conducted as usual, except when it is desired to produce a fulness on one side of the cloth; the moveable clamp on the opposite side is then made to press the warp threads, and retain them while the workman continues the weaving with a hand shuttle in that half of the warp where the fulness is to be made, gradually diminishing the length of the throw of the shuttle until it is completed, when the jaws on that side are made to act so as to draw the cloth parallel to the breast beam of the loom.

2. The arrangement for conveying instruction to the weaver consists of a diagram containing a number of vertical divisions which correspond to the divisions in the temple of the loom, and across which are drawn horizontal lines, whereby the operator is guided in working the course of the treadles.

*Claims.*—1. The arrangement and construction of machinery for combining weft threads with warp threads to produce shapes for outer articles of wearing apparel.

2. The application of drags or clamps to warp threads.

3. The mode of conveying instruction to the workman.

Augustus Rœhn, Paris, gentleman. *For improvements in making roads and ways, and in covering the floors of court-yards, buildings, and other similar pur-*

*poses.* (A communication.) Patent dated August 1, 1849.

The object of this invention is the employment of natural or artificial asphalt in a cold state; and it is proposed to be conducted by either of the following methods, according to the resources and character of the locality where the paving or covering is to be effected:—

1. A mastic is composed of 176 lbs. of asphaltic rock; 15 lbs. Bastenne pitch, or coal tar, or pitch, of analogous consistency; 7 lbs. pyrogenous oil of resin, or other fixed oil. Or, when the asphaltic rock cannot be procured, the mastic may be composed of 220 lbs. of common, gray, or hydraulic lime; 170 lbs. refined coal tar; and 7 lbs. pyrogenous oil. The pitch is first melted, and the asphalt or lime added, after which the oil is poured in, and the whole made to simmer gently until the ingredients are thoroughly incorporated. It is then cast into slabs, which, when cold, are employed for paving, as in the ordinary manner, sand being added in the proportion of about 60 per cent.

2. The road is levelled, and a stratum of wet gravel, about two inches deep, rammed down smooth over it. A layer, about four inches deep, of Macadamized stones is laid upon the gravel, and then, above the stones, a second layer of asphaltic rock, broken into pieces of two inches, one inch and a half, and half an inch in size, which have been placed in an open basket and dipped in pitch. The road is next beaten or rolled level, to cause the pieces of asphaltic rock to bind together, and the interstices between them are filled with an elastic mastic which is ladled on to the road and scraped over it, as is well understood by asphaltum layers of the present day. Being of a yielding nature, this sort of paving affords firm footing to cattle travelling upon it. The elastic mastic is composed of 22 lbs. Bastenne pitch; 88 lbs. pyrogenous oil; 686 lbs. asphaltic rock; 206 lbs. gravel; or, 88 lbs. Bastenne pitch; 88 lbs. pyrogenous oil; 686 lbs. of any suitable calcareous substance; and 206 lbs. gravel.

Instead of the elastic mastic, it is in some cases proposed to employ what the patentee terms "mastic in the form of sand." It is composed of 25 lbs. Bastenne pitch; 65 lbs. pyrogenous oil; 780 lbs. asphaltic rock; and 275 lbs. gravel. Or, 100 lbs. Bastenne pitch; 100 lbs. pyrogenous oil; 690 lbs. lime; and 275 lbs. gravel.

3. When asphaltic rock is not easily to be procured, it is proposed to employ instead thereof pieces of rag-stone or potter's earth, which are well dried, and afterwards steeped in a mixture of 110 lbs. Bastenne pitch and 5 lbs. pyrogenous oil. The pieces are dusted with some calcareous substance, in powder, and the oil is subsequently allowed to drain from them, after which they are ready for use.

4. Where parts of the road are worn away, they are to be brushed over with a mixture of Bastenne pitch and pyrogenous oil, and gravel sifted over them.

The pyrogenous oil is employed to toughen the material, and a road constructed as above described, will, it is said, be ready for traffic in forty-eight hours after it has been completed.

*Claims.*—1. The preparation of a hard and durable mastic, by the employment of bitumen, pitch, fixed oils, and calcareous substances.

2. The mode of preparing the elastic mastic.

3. The preparation of artificial asphaltic rock.

4. The preparation and use, in a cold state, of mastic, or natural or artificial asphaltic rock, in combination with stones or other hard substances, to form a covering for a road.

5. The mode and use of mastic in the form of sand.

6. The preparation of asphaltic rock in such a manner that, without heat, it shall be rendered soft and binding by beating or rolling, whereby a durable asphaltic covering to the road is formed.

William Geeves, Battle-bridge, Middlesex, saw-mill proprietor. *For improvements in the manufacture of boxes for matches and other purposes.* Patent dated August 1, 1849.

The patentee describes and claims—

1. The making of boxes for matches or other similar purposes, with partitions, cut from a length of board, having saw-cuts on both surfaces, pasted over with paper, or other suitable fabric—such saw-cuts serving as receptacles for the matches separately.

2. Making match-boxes from scale-board, having the paper hanging over the two ends, so that when it is bent round they shall lap over the joint both inside and outside.

3. Cutting the scale-board with partial indentations on both sides, to form rebates for the top and bottom of the box.

4. The use of expanding and contracting mandrils, round which the board is wound to form the box. This principle of construction being employed to allow of the box being removed from the mandril while wet.

5. The employment of a rotary hollow spindle, with a sharp serrated end, to produce discs to form the tops and bottoms of match-boxes, and making them of two thicknesses of wood, pasted together with the grain in different directions, to counteract the action of warping.

6. An apparatus for cutting a cylinder of scale-board (formed as before described) into lengths for match-boxes, which consists of

a lathe, in which it is held, and made to rotate against the edges of cutters placed at certain intervals from each other.

7. Making the saw-cuts in scale-board of a square, instead of a V form, to admit of better joints being obtained when folding.

8. An apparatus for making saw-cuts in the scale-board for the joints, as well as a rebate on one side for the lid.

GEORGE FELLOWS HARRINGTON, Portsmouth, dentist. *For improvements in the manufacture of artificial teeth, and the beds and palates for teeth.* Patent dated August 1, 1849.

The patentee remarks, that it has hitherto been customary, in manufacturing artificial mineral teeth, to take a mould of the mouth, according to which the bed or palate in gold is shaped, and to cut away the lower part of the teeth fitted to the bed, to suit the irregularities of the mouth, which is a work of great difficulty, requiring great nicety and skill in the workman, on account of the tendency of the mineral to shrink during firing; and that the object of his invention is, to construct the teeth without reference to the shape of the mouth. Having observed, in the course of his experience, that there is no very great difference in the size of the mouth of different individuals, he makes his mineral teeth in sets of three or four different sizes. When it is desired to fit a person with a set of teeth, a cast of the mouth is to be taken in soft wax, furnished with teeth or projections to enable the dentist to judge what should be the length of the teeth. The height, breadth, and depth of the mould is then ascertained by a measuring instrument, which consists of a sole plate, having on each side two graduated uprights, over which slides a graduated horizontal bar, which has another graduated horizontal bar extending from the centre, and at right angles to it. The mould is placed upon the sole plate, underneath the graduated bars, which will at once indicate the different dimensions of it, so as to enable the operator to select the required sized set of teeth. A cast of the mould is taken in type metal, which is placed on the bed-plate of a compressing machine, underneath a presser plate, and between two side-compressing levers. A piece of tortoise-shell is cut to the required size, then placed on the mould, and between that and the presser plate a cork is introduced. The whole is placed in hot water to soften the shell, and the presser plate and levers gradually made to act upon the top and sides of the shell, so as to mould it to the type-metal mould. When cool and set, the shell is taken out, and the teeth finished.

*Claims.*—1. The mode of manufacturing artificial mineral teeth, whereby forming teeth according to the shape of the mouth, and cutting away portions of them, are rendered unnecessary.

2. The machinery employed in such manufacture.

3. The employment of tortoise-shell to form the beds and palates of artificial teeth, and also palates for the mouth where no artificial teeth are required.

BENJAMIN AINGWORTH, Birmingham, button-maker. *For certain improvements in iron and other metals for use in the manufacture of gun-barrels, and all articles to which the same ornamented metals may be applied.*

These improvements consist in various new modes of combining iron and steel to be afterwards manufactured into gun-barrels, which, will, in consequence, on being subjected to the action of acids, have an ornamental surface; and in compounding iron and brass, or iron and copper, for producing ornamental surfaces on other articles than gun-barrels. We quote a few examples:—

1. A sheet of iron or steel has a pattern stamped out on it, and is laid on a sheet of steel or iron—the two sheets being of different metals—heat is then applied, and the two subjected to pressure in order to imbed the one in the other. They are afterwards thoroughly incorporated by welding or otherwise, and made into plates, skelps, or ribands, to be subsequently manufactured into gun-barrels, which are browned by acid, whereby the resulting difference in the colours of the iron and steel will cause the pattern to be visible on the surface.

2. The stamped-out portions of iron or steel are imbedded in a sheet of steel or iron, and made up as before.

3. Wires of iron or steel are laid on a sheet of steel or iron in any form fancy may dictate, and welded together.

4. Iron and steel wires are twisted into strands, or strands of iron wire and steel wire are made into ropes, which are afterwards to be welded together.

BENJAMIN THOMPSON, Newcastle-upon-Tyne, C.E. *For improvements in the manufacture of iron.* Patent dated August 1, 1849.

Mr. Thompson causes the air to pass into a blast furnace by exhaustion instead of injection, and effects this by constructing a gallery in the masonry of the body of the furnace, which communicates on one side with the interior by a number of vent-holes opening into it just underneath the dome; and, on the other side, with two pipes, into which steam pipes, leading from a boiler, open, so as to create an exhaust. The top of the throat is closed air-tight by a cover, and the air allowed to enter by the tuyeres. Or the use of steam may be dispensed with,

and the gallery connected to a chimney tall enough to produce the necessary draft. It is also proposed to utilise the products of combustion by causing them to pass from the top of one furnace to the bottom of another, which is connected at top to the exhaust.

No claims are made in this specification.

JOHN PARKINSON, Bury, Lancaster, brass founder. *For improvements in machinery or apparatus for measuring and registering the flow of liquids.* Patent dated August 1, 1849.

*Claim.*—1. An apparatus of peculiar construction for measuring and registering the flow of liquids under uniform and varying pressure. Description in our next.

DAVID HARCOURT, Birmingham, machinist. *For improvements in vices and in the manufacture of hinges, and also in apparatus for dressing and finishing articles.* Patent dated August 1, 1849.

These improvements in "vices" consist in making one jaw of the vice to slide in parallel guides, and the other to turn on a pin, like the smith's ordinary vice. The parallel jaw is divided into two parts, the lower one of which has two inclines upon its upper face, which correspond to two inclines upon the under face of the upper part of the jaw, so that as the jaws are brought together by the revolution of the screw which works in both, the upper part of the parallel jaw will be forced up, whereby the grip will be increased, and the whole parts held solidly and firmly, so as to allow of the article held therein being hammered and worked securely.

The improvements in the "manufacture" of hinges, consist in subjecting pieces of metal to the action of certain very intricate and complicated machinery, which cuts them into shape, countersinks and drills the holes therein, and dresses and finishes them, without the necessity of their being handled or removed.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Edward Highton, of Clarence Villa, Regent's-park, Middlesex, engineer, for improvements in electric telegraphs, and in making telegraphic communications. February 7; six months.

Charles Atherton, member of the Institution of Civil Engineers, of London, for an improved apparatus or machinery for regulating the admission of steam to the cylinders of steam engines. February 7; six months.

Thomas Auchterlonie, of Glasgow, manufacturer and calico printer, for improvements in the production of ornamental fabrics. February 7; six months.

Edward Ormerod, of Manchester, mechanical engineer, and Joseph Shepherd, of Chorlton-upon-Medlock, mechanical engineer, for improvements in or applicable to apparatus for changing the position of carriages on railways. February 7; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Jan. 31 | 2168 | Francois Van Den Brande | Bedford-street, Bedford-square | Extending loo table. |
| ,, | 2169 | George Houghton | Birmingham | College cap. |
| Feb. 2 | 2170 | John Sanders | Birmingham | Door knob. |
| 4 | 2171 | David Mather | Dundee | Automaton blow-off apparatus and salinometer for marine steam boiler. |
| 6 | 2172 | Langman, Ward, and Co. | Wolverhampton | Burner for burning luxurine or other spirit. |
| ,, | 2173 | Thomas Wharton | Birmingham | Inkstand. |
| ,, | 2174 | Henry Hopwood | Scarborough | Portable mangle. |
| ,, | 2175 | J. and E. Ratcliffe | Birmingham | Universal reservoir inkstand. |
| 7 | 2176 | Josiah Sims | Tavistock | Oven for a domestic cooking stove. |

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1384.] SATURDAY, FEBRUARY 16, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## MAZELINE'S PATENT EQUILIBRIUM SLIDE-VALVE.

Fig. 2. Fig. 1.

Fig. 3.

## MAZELINE'S PATENT EQUILIBRIUM SLIDE-VALVE.

It is well known that the ordinary steam engine valve-slide consists of one surface provided with two steam ports and one eduction passage. The principle of the equilibrium slide-valve of M. Mazeline is described by him as consisting in this—that "it slides on or between two surfaces, each surface being provided with two steam ports and one eduction passage, and such ports and passages standing in opposite directions to each other." The advantages derived from this arrangement are, that "the valves covering such ports and passages will counterbalance each other, or nearly so, and thereby diminish the pressure and friction of the valves when they are moved."

Fig. 1 is a longitudinal section of a steam cylinder, supposed to be the cylinder of a locomotive engine, to which the equilibrium valve is applied. Fig. 2 is a horizontal section taken through the valve at the line A B; and fig. 3 is a cross section of the cylinder and valve. In each of these figures, C is the valve-box, and V the valve, which may be said to assume the form of the letter V, truncated when shown in the cross section, and which valve sticks against two plain surfaces in the valve-box, the surfaces standing at a slight inclination to each other when viewed in cross section, in order to ensure the valve fitting steam-tight against the two surfaces. D D and D′ D′ are the induction passages for the steam—all being of equal dimensions, and placed in opposite directions to each other, so that when the valve is in the position shown in the engraving, the steam will enter through D′ and D′ at the same time, and will pass into the cylinders by the channels D′ formed in the valve-box, which discharge the steam into the ordinary steam passages E′ of the steam cylinder, or by means of two smaller channels leading to the end of the cylinder, and cast, together with the valve-box, on the cylinder itself. When the position of the valve is reversed, the same operation will take place by the passage of the steam through D D into E. F and F are the eduction passages. G is a wedge fitted in the lower part of the valve-box, and on which the valve slides. H is a screw fitted to the wedge G, by which the valve may be adjusted to the surfaces, and whereby the valve is supported and kept steam-tight. K and K′ are orifices in the lower part of the valve-box, for the purpose of facilitating the escape of prime water from the cylinder when occasion may require; in such case the wedge G covering the orifice K will be lifted up by the water in the same manner as in an ordinary valve. L is the steam pipe or passage communicating with the steam chamber M on the valve-box.

The following approximative calculation of the saving of power which would be gained by the adoption of this valve in the case of locomotive engines, has been furnished by Mr. C. A. Holme, C.E.:—

*Calculation.*

I will take the slide-valve of a 14-inch cylinder, which is about 9 inches by 11; or 99 square inches of surface, from which is to be deducted the area of one of the induction passages, or 13 square inches, leaving 86 square inches of surface on each valve subjected to the pressure of the steam. Now, 86 square inches multiplied by 50 lbs. pressure of steam, gives 4,300 lbs. of pressure on the valve, which, when multiplied by a friction coefficient of 0,2, gives 860 lbs. of traction for moving the valve; the stroke of the valve is 4 inches, making 150 double strokes per minute = 100 feet velocity or space moved through by the valve in one minute. The velocities on the rubbing surfaces of the eccentrics, say 12 inches diameter, are 450 feet per minute.

*Power Consumed.*

| | |
|---|---|
| 2 engines × 860 lbs. of traction to move the valve × 100 feet velocities per minute on the rubbing surfaces of the valve . . . . | = 172,000 lbs. lifted one foot, |
| *id.*, friction from two eccentrics × 860 lbs. pressure from the eccentric rod × coefficient 0,1· × 450 feet velocity at the circumference . . | = 77,520 lbs. lifted one foot, |
| Pounds lifted one foot | = 249,520 = 7·56 H. P. |

The equilibrium valve will only require one-tenth, or 0,75 of the power consumed by the ordinary valve, thus offering a saving of 6,8 horses power; but this is not the only advantage of the equilibrium valve, as a much greater advantage will no doubt be that of the reduced wear and tear of the slide gear, which is the most delicate part of a locomotive engine, and also the increased facility for manœuvring, stopping, or reversing the engines.

It should be observed that the coefficient of 0,2 is less than what M. Morin has found it to be when the rubbing surfaces are of gun-metal, working on cast iron, without lubrication. The saving of 6·8 horses power on a luggage train working at 14 miles per hour is equal to 180 lbs. of traction, or an increased load of 20 tons may be taken with an engine fitted with the equilibrium slide-valve.

## THE SCIENTIFIC ALMANACKS.

*The Nautical Almanack.*
*White's Ephemeris.*
*The Lady's and Gentleman's Diary.*
*The British Almanack and Companion.*
*The Illustrated Almanack.*

Bookshops, at this season, are crowded with almanacks. Such is their number, that it would fill a long article to give even an outline of these annual competitors for public favour. They are devised and made to suit almost every person and every purse—from the costly calendar in morocco and gold, for the rich man's mansion, down to the mere piece of paper for the cabman's cap. Every county has its almanack, and so has nearly every locality, profession, party, trade, and sect. Wherever you may be, or whatever you are, there are almanacks waiting to suit your whereabouts and your pretensions. Whether you remain in old England, or emigrate to the most distant parts of mother earth, the almanack-makers are alike accommodating, and at hand to afford you their assistance. Although many of these ephemerals are mere catch-pennies, it must be admitted that a large number of them contain a very great deal of highly useful information upon their peculiar subjects; generally speaking, they fairly compete with each other in the endeavour to give the greatest quantity of information, of the most serviceable kind, at the lowest price. The public, whilst it duly fosters and encourages this spirit of rivalry, is much benefited by its operation.

As might be expected, no inconsiderable number of these annuals are wholly, or to some extent, devoted to science. We think a notice of a few of the almanacks which are commonly classed under this denomination, and which we have named above, will not be uninteresting to our readers.

*The Nautical Almanack*, the first in our list, is published by order of the Lords of the Admiralty, and is considered the National Almanack; it was commenced in 1767, and has been continued ever since, without intermission. Considering how much we depend upon our navy, it is remarkable that the *Connaissance des Temps*, the French national almanack, composed almost to answer the same ends as our Nautical Almanack, had been published nearly a century before, that having commenced in 1698.

As affecting our Navy and maritime affairs, the publication is of great importance; indeed, it would be difficult to name another of so deep concern to the British public. The full truth of this will be at once perceived when it is recollected that the tables in the Nautical Almanack with respect to the sun, moon, fixed stars, eclipses of Jupiter, satellites, &c., adapted to the meridian of Greenwich, enable the navigator, by comparing these tabular results with the distances, eclipses, &c., carefully made at sea, with comparative ease and certainty, to infer his longitude with sufficient accuracy for nautical purposes.

The contents of this almanack are:

The principal articles of the calendar.

The elements and ephemeris of each of the planets.

The configurations, occultations, and eclipses of Jupiter's satellites.

Co-ordinates of the sun.

Equation of time.

Equation of the equinoctial points.

Equinoctial time.

Lunar distances—corrections for second differences of mean time of transit of the first point of Aries.

Moon-culminating stars.

The meridian ephemeris—phases—perigee and apogee—Libration—and mean longitude of the orbit of the moon.

Obliquity of the ecliptic.

Latitudes and longitudes of the principal observatories. Occultation of stars, by the moon, visible at Greenwich, with elements for computing.

Pole star—tables to find the latitude by.

Stars—mean and apparent places of—constants for reduction of.

Eclipses of the sun and moon.

Aberration and parallax of the sun.

Tides,

&c. &c. &c.

There is an instructive preface by the Superintendent, giving some account of the origin of the contents, and pointing out the methods by which many of the corrections, &c., have been obtained.

At the end, there is an explanation of the various articles contained in the publication. This part of the book contains a most valuable store of information for the practical astronomer. The rules enumerated are clear and unambiguous; and the illustrations are exactly adapted to answer their purpose. Whether student or practical man, whether landsman or seaman, if he be at all prepared to enter upon such subjects, he cannot misapprehend the rules so judiciously and carefully laid down for his guidance.

We are pleased to see that some of Mr. Woolhouse's valuable improvements, which were first published in the appendix to the Nautical Almanack for 1836, are still referred to and made available. We think the country sustained a serious loss when it was induced to part with that gentleman's most efficient services. How strange it is that the public, or men who rule the public, do not retain and encourage such highly talented servants, instead of treating them scurvily, and trying to starve and bully them into mere pieces of machinery! We trust that such official tyranny will soon be only a matter of history, and that the reign of jack-in-office despots is fast drawing to an end.

The aim of the compilers is obviously to render the publication as replete as possible with useful matter—and we think they are eminently successful: it is, therefore, not in any manner to find fault, but with the wish to throw out a serviceable hint, that we advert to two articles in the *Connaissance des Temps* for 1849; the one, a Table of the Geographical Positions of Principal Places—showing their latitudes and longitudes, and the authorities on which they rest; the other, a General Table of Meteorological Observations made at the Paris Observatory. We think a table similar to that first-mentioned would be highly useful to the readers of the Nautical Almanack, whether navigators or others; and we are of opinion that a serviceable table might also be concocted from the mass of meteorological facts which are daily accumulating at Greenwich.

In reference to the table of Geographical Positions, as a hint to those whom it may concern, M. Daussy says (257), "La position de la pointe S. Leven, qui avait pris dans Mudge (tome ii., p. 114), a été supprimée, comme ne se rapportant pas à la pointe qui porte ce nom sur les cartes."

The Nautical Almanack, being published under the direction of the Lords of the Admiralty, is not subject to the public competition to which we have referred; nevertheless, it is only common justice to admit that the publication does great credit to the Lords Commissioners of the Admiralty; their names ought to be given, that the country may know to whom it is indebted for so truly valuable and so characteristically national a work. We have said that the Nautical Almanack is looked upon as the National Almanack; it is only fair to add that, in our opinion, it is justly entitled to be so considered. The vast labour and talent bestowed upon its contents; the care and expense which are incurred in placing the

bulky volume of upwards of 600 pages in the hands of the public, at the cost of 5s., reflects great credit on the country. No publisher could undertake to obtain and publish so much intricate matter, with like accuracy, for less than many times its cost.

The Nautical Almanack, we believe, is published three or four years in advance, for the purpose of supplying ships which take long voyages. The publication, on this account, must be peculiarly beneficial to the whole host of almanack makers who treat on astronomical subjects; for if they do not use what is ready made to their hands, the book must be highly useful to them to test the correctness of their own calculations.

It was our intention to enter into a comparison of the contents of our Nautical Almanack with those of its rival, the *Connaissance des Temps;* but we shall defer it for the present. The Nautical Almanack for 1851 will contain Mr. Adams's paper "On the Perturbation of Uranus;" and when it comes, in due course, before the public, we are quite sure that that gentleman will expect that we shall again enter upon the subject with peculiar delight. Whilst we have a thorough loathing for mean, cowardly, crawlers—we have an especial pleasure in maintaining the claims of men who are truly grateful as well as highly-talented: Mr. Adams, therefore, will find that he cannot be disappointed—and the occasion will afford us an opportunity for making the comparison to which we have adverted.

Adam Smith very clearly demonstrated the advantages which accrue from the "DIVISION OF LABOUR." Most writers on political economy, to some extent, agree with him; but no men, whether practical or theoretical, have been more active in testing the doctrine by real practice, than the chiefs of many Government departments. They very soon clearly perceived the desirable results to which that economical principle would lead in their own cases; they not only, therefore, became converts to its importance, but they were first and foremost in practically adopting it, and in giving its applicability full play. The consequence has been, that when a chief happened to have any duties, an under-chief or two has been created to perform them; these latter officials, also imbued with Adam Smith's doctrine, must have secretaries, who, again, must have clerks, who must in their turn have cads, &c., &c., until the system has been most beautifully carried into operation—barring the expense, which in so fine a theory, so exquisitely made practical, clearly never forms an element in the consideration of its practitioners. We are not prepared to assert distinctly that Adam Smith's principle of division of labour has been applied to the preparation of the Nautical Almanack. In the absence of direct proof, one way or the other, we will simply relate what has actually occurred, relying upon history for the correctness of the narration, from which the reader may draw his own conclusions:

The late Dr. Maskelyne was appointed Astronomer Royal in 1765. Immediately after his appointment to the office, he recommended the lunar method of finding the longitude to the Board of Longitude, and proposed to them a nautical almanack, to be calculated and published to facilitate the method: they acceded to the proposal, and the first Nautical Almanack, as we have before said, was published in 1767. It was subsequently published, under Dr. Maskelyne's direction, with the greatest credit, through forty-eight successive years. It should be steadily kept in mind that Dr. Maskelyne was Astronomer Royal *before* Adam Smith's bewitching doctrine had began to make converts of the chiefs of Government departments; and we are told that the celebrated astronomer *continued indefatigable at his public duties, hardly ever quitting the observatory.* He made many of the most interesting and difficult observations himself: he brought to perfection the methods of Bradley and Flamstead: he published a carefully-determined catalogue of stars; and on important occasions gave useful directions to other astronomers. He much improved all his instruments: according to the best accounts, he was a most

laborious public officer, who assiduously attended to the duties of his high post, and richly deserved the title of "Astronomer Royal." We learn from Dr. Hutton's Dictionary, and from the Encyclop. Metrop., Art. Almanack, that the Nautical Almanack maintained a character for remarkable accuracy and perfection from the period of its first publication to the death of its celebrated institutor and conductor. However, "*tempora mutantur;*"—and, although Adam Smith's doctrine of division of labour may not, in the interval, have been adopted at the Royal Observatory, still one fact appears to be indisputable—the Nautical Almanack at present, so far from being conducted and superintended by the Astronomer Royal at Greenwich, has a separate establishment of its own, formed at Gray's Inn, ten miles off. Thus, then, stands the matter—the Nautical Almanack, during the first forty years of its existence, was superintended and conducted with deserved credit by the Astronomer Royal at Greenwich, whose various other astronomical labours gained him high repute and the nation much celebrity. Since that, for reasons which, at all events, are not generally known, an independent staff has been created and established for the publication. We merely state the fact—we can offer no satisfactory explanation of this division of labour. We know that the last few years have been remarkable for the great number of astronomical discoveries which have been made. New planets, new comets, and other striking phenomena, have frequently rewarded the astronomer's vigilance and labours. It may be, therefore, that the Astronomer Royal, feeling that he is the highest scientific officer which the English public employs, has found the immediate duties of the Observatory so imperative, that he has been obliged to relinquish to others the superintendence of this truly British publication. It may be, that the Astronomer Royal, having a due regard to the high office which he fills, and a corresponding solicitude for the credit of English science, has found so much of his time occupied in verifying the new discoveries of his countrymen, and in testing the accuracy of their astronomical achievements, that he has been constrained to restrict his official duties to the Observatory. It may be, that when a new planet has been discovered by means of an entirely novel process, and the result communicated to the Astronomer Royal, he has felt himself bound, as the chief national scientific officer, at once to test the accuracy of such new speculation, so as to secure the honour of such a singular discovery for his countryman who has made it, and to guard it safely against the pretensions of any foreigner who might subsequently lay claims to it. Prompt and anxious attention to such matters would, in our opinion, completely justify the Astronomer Royal for handing over any extraneous duty, however weighty, to a competent quarter. There may be proof that our late Astronomers Royal have been altogether successful in such praiseworthy exertions,—that, by their assiduous attention, and promptitude in the use of the means under their control, they have secured Englishmen's rights from the claims of foreign rivals. If they have thus worthily and successfully laboured for the country's scientific credit, give us some proof of it, and we have not one word more to say, except that any high officer, who so meritoriously discharges his important duties, should be rewarded by wealth and honours, so as to show that a great nation can duly appreciate the value of services which add lustre to its greatness, and brilliancy to its celebrity.

But, if the division of labour to which we refer was carried into effect purposely to enable the Astronomer Royal, whoever he may be, to become a sort of official lackey, ready to take a hand in every job, and to assist in every scheme, whatever be its nature,—if it were to allow that public-paid officer to go where he pleased, and to do whatever his whim or caprice prompted,—why, then, we consider that Adam Smith's doctrine of Division of Labour has been injudiciously applied, and that some regulation is wanted to remove the mischievous anomaly which has been introduced.

Lest these remarks should be misunderstood or misapplied, we repeat, that we simply state the fact—that the Nautical Almanack, during the first forty years, was conducted and superintended by the Astronomer Royal at Greenwich,—that at present, a separate staff and establishment are supported for it at Gray's Inn,—when, or how, or why it was removed from Greenwich, we have nothing to say, and consequently we refer to no particular Astronomer Royal. We have stated the only reasons which we think can in any manner be alleged as a justification for removing the publication from under the Astronomer Royal's superintendence. If the Royal Observatory be publicly supported on account of its especial connection with the navy,—if the Astronomer Royal be the chief officer of that public establishment, it is difficult to imagine what duties (except the particular ones which we have named) can be performed, that necessarily preclude the Admiralty's chief scientific officer from superintending their principal publication, upon the accuracy of which such vast interests depend. The Nautical Almanack, as far as general utility is concerned, would seem to be the very pith of astronomical labour, and to ensure its accuracy the most anxious part of the Astronomer Royal's duty. However, be this as it may, we have heartily expressed our opinion respecting the high efficiency of the publication. One word on the score of expense:—if report be correct, the stipends given to the men who perform nearly all the preparatory work are thoroughly disgraceful to the country. We cordially join in the hope that the time is drawing near when high salaries, paid by the public, will undergo a searching revision, and be duly proportioned to the services performed. Weighty and laborious duties, efficiently done, ought to be fairly and liberally remunerated. The demand for the abolition of nominal offices, to which large salaries and no labour are attached, is quite rational, and must be effectually treated; but how men can raise the cry about lowering salaries, and be altogether silent with regard to the utter niggardliness to highly talented and accomplished men, who rack their brains incessantly in the public's most important service, it is impossible to say: their silence, however, on the one head, throws a dark suspicion on their clamour about the other. But how is it, that the chiefs of such establishments do not bestir themselves, and endeavour to get their underlings somewhat better paid than the shirt-makers? Is it true, that some of the heads of such departments advocate small pay because it makes subalterns submissive and *laborious?* If the rule be correct, might it not judiciously and *profitably* be applied to the chiefs themselves? What is sauce for the goose is sauce for the gander: under such circumstances, if rumour be true, this supposed truism ought to be tested.

*White's Celestial Atlas, or Ephemeris,* contains—The Geocentric Places of the Planets; Eclipses; Occultations; Tide Tables; The Mean Places of the Principal Fixed Stars; Planetary Phenomena; besides the usual information with regard to law terms, calendar, &c., contained in other almanacks. This useful Ephemeris has been published annually during a hundred and one years. It is now published by the Company of Stationers, who have placed it under the able superintendence of Mr. Woolhouse—a guarantee for the accuracy of its contents. In the Ephemeris for 1835 there was an Appendix given, and it was proposed to attach an annual Appendix, consisting of such tables, rules, investigations, or other matter connected with the theory or practice of astronomy, as might be best calculated to be useful to persons who are devoted to astronomical and nautical inquiries or operations. In accordance with this announcement, much valuable and interesting information has been published.

First, in 1835—Tables and Rules for Facilitating Astronomical and Geodetical Computations. By M. Burckhardt and Baron Zach.

In 1836—Tables and Theorems by Bowditch, Ganes, and Burckhardt, for Computing the Orbits of Comets.

In 1837—A Selection of Tables Useful in Practical Astronomy and Navigation.

In 1838—Tables of Logarithms, Series, Tangents, &c.

In 1839—A Practical Abstract of Mr. Woolhouse's Rules and Formulæ for the Computation of Solar and Lunar Eclipses, and Occultations of the Stars and Planets by the Moon.

In 1840—Professor Schumacher's Account of the Methods of Establishing and Fixing an Observatory at Heligoland, with a Record of the Observations, &c.

In 1841, Tables were published for the use of nautical men and astronomers, intended as supplementary to the Nautical Almanack and White's Celestial Atlas, by Dr. Gregory, Mr. Woolhouse, and Mr. Hann; price 4s. 6d., or, with the Ephemeris, 5s. 6d. Since then the proposed Appendix, which so highly enhanced the value, utility, and interest of the Ephemeris to its readers, has been discontinued. Why the proprietors have not followed up the plan which was proposed in 1835, we are unable to say: we ought, perhaps, to be thankful as it is for the valuable papers that were given in the Appendix. However, the cutting off the proffered addition has attached a sort of sterility to the publication which would not have been so perceptible if the Appendix had never been given.

The Ephemeris, however, is well worth its cost. The country is indebted to the Company of Stationers for this and many other similar publications of long standing and great usefulness. They might easily introduce one great improvement, if they would cater for their advertising sheet among the scientific booksellers, and give a list of new and rare works; they would thereby add to the interest of their publication, and probably to the advantage of their friends and customers. The Company cannot possibly want to get rid of the scientific people who purchase their annuals, and yet this assumption is difficult to be supported in the teeth of the fact, that at the end of each of their scientific almanacks, they every year offered their readers with a long list of nauseous quack nostrums.

*The Lady's and Gentleman's Diary.*

A writer in the *Metropolitana* says, "The influence of the Lady's and Gentleman's Diary on the mathematical sciences of this country is very remarkable. It is generally allowed by foreign authors that there is in this country a far greater portion of the population acquainted with mathematical science, to a certain extent, than in any other part of Europe; and there is no doubt that this circumstance is to be principally attributed to the two publications above mentioned (now one); the proposing of questions from the most easy to the most difficult one year, to be answered in the following, and the chance of having the solutions printed and published under the names of their respective authors, is well calculated to excite emulation in the heart of any young man who has imbibed a love for mathematical pursuits: he begins by sending the solution of some of the easiest questions, and proceeds till he is at length qualified to answer most or all those that are proposed. His attention is drawn to the subject, and from an amateur he becomes a proficient. Many of the most distinguished English mathematicians of the last century, and whose works are an honour to their country, began their pursuits with the Lady's Diary; of these we may mention, in particular, *Simpson, Emerson, Landen, and Wildbore.*"

A long list of distinguished names, such as Hutton, Gregory, Horner, &c., &c., might easily be added, were it necessary. Now, admitting that this little annual, and its equally unpretending companions or competitors, have been so instrumental, not only in *making* mathematicians, but in giving a singular and distinguishing characteristic to the population of this country during the last century and a half, is there any other work, however voluminous or costly, which has effected such important results? If there be, it is unknown to us. Can such effects be justly ascribed to the Philosophical Transactions, which contain the labours of our most noted scientific men during an equally long period? Certainly

not. Highly valuable as that very costly work is, its influence has been, and is, confined to within comparatively narrow limits; its cost circumscribes its circulation as well as its utility; only a very select order of readers have the opportunity to peruse it; and, very likely, part of that order have not the taste for such reading. But if the Philosophical Transactions fail in the comparison, clearly no other work can be mentioned to support it. The moral effect of this esteemed annual should not be overlooked. Whilst it is making self-teaching students mathematicians, it at the same time prevents them from following vicious pursuits; their example operates upon their companions and friends; hence the influence of the Diary, &c., in this point of view ought not to be forgotten.

This country is become distinguished for the high order to which its mechanical inventions have been carried—for our superb steam engines, and for the refined mechanism which these engines put in motion—for our scientific apparatuses and delicate philosophical instruments. It frequently requires no ordinary degree of scientific acquirement and mathematical knowledge, even in the mechanics who have manually to construct those refined pieces of mechanism; and these are the men whom the Diary instructs. During the last century and a half, the Diary and its coadjutors have been leading self-teaching artizans from their first entry upon mathematical science up to its fountain head. Do we then claim too much for the Diary's influence, when we assert that England's fame for matchless machinery is, to a considerable extent, owing to the effects which that little annual has produced?

But if the Diary and its companions have caused such singular effects—and we believe they are indisputable—is it not strange that no men in power have ever recognized their influence, or done them the small justice to acknowledge it? So far were our fiscal governors from encouraging the Diary, that, up to a recent period, they imposed a tax of more than a hundred per cent. upon its value. This unmitigated Vandalism proves that tax-raters must be fed, even though the vitals of science be drawn out to gorge them. However, the valued little periodical now before us, is the one-hundred and forty-seventh of its kind, and here it is, as vigorous, as full of life, and as highly valued as ever. It is true, we see a cockney scribe once now and then turn it over, in a state of the most blissful ignorance as far as his knowing an iota about it is concerned; he can only talk about its "*puzzles, mathematical and poetical.*"

This is a capital number. In 1842, the first year after the Lady's and Gentleman's Diaries had become one twain, there were ninety-nine mathematical correspondents, twenty-nine of whom answered the Prize Question. The present number is well adapted to attract an equally long list. Much of the poetry is excellent, and the philosophical queries are interesting. The Diary has gained its deserved esteem by enabling self-taught students and *others* to show what they can do, and not by proposing difficulties which only a very select few can surmount. The Diary for 1850, we are pleased to observe, is again in its track of usefulness. The novice and the proficient may each, in this Number, find something to exercise his abilities: we trust, next year, to find that they all have availed themselves of Lady Di's politeness, and that her list of guests will be a long and splendid one.

Since 1835 there has been an Appendix given to the Diary. The mathematical papers which have been published in this part by Messrs. Davies, Horner, Woolhouse, Gill, Rutherford, Weddle, Beercroft, Kirkman, Tobay, Cockle, &c., have been of the most valuable description. The Horæ Geometricæ, commenced by Professor Davies, and assisted by Rutherford and Weddle, are a treasure-house of elegant formulæ. Mr. Beercroft's papers on Concordant Circles, Harmonic Curves, and Theory of Reciprocity, are as elegant as they are easily applicable to the solution of a variety of interesting inquiries.

The Appendix to the Diary for this year contains an article, entitled—Some Hints on

Line Co-ordinates, by the Rev. Mr. Kirkman—

The Moment of Inertia of a Solid referred to Oblique Axes, by Mr. Tobay—

A method for Computing the Hebrew Calendar, by Mr. Fillisponski, and a continuation of Professor Davies's valuable dissertation on Radial Axes and Poles of Similitude.

Mr. Kirkman's paper is published with the view of making known to the English student Professor Steiner's method of treating some important theorems. At the end of the article, the author has made some remarks which we think deserve notice, and by way of giving them a wider circulation, and also for the purpose of making a few observations upon them, we place them before our readers. Mr. Kirkman says, "I hope that it may be considered not out of place, nor entirely useless, to remark here, that these properties of Professor Steiner's are not only among those, of which, to use the words of Professor Davies (Diary, 1849, p. 771), 'we shall search in vain in any English work for a development, or even a collection,' but of which no hint has hitherto been furnished, so far as I can learn, to the English reader.

"They are of great beauty and importance; for, from the sublimest branch of mathematical knowledge, in every accessible and attractive department of plane geometry, they have been for a length of years a matter of great interest to our own accomplished mathematicians, and familiar topics among the less advanced students of the continent; but they are fairly outside the Elements, and have, consequently, not yet been alluded to in any English treatise.

"I suppose that it is one of the things of which we all feel proud, as the most practical nation in the world, that mathematical works hardly ever make their appearance among us, except such as are specially intended for school-boys and undergraduates. There is no reading and purchasing public for books on pure science in England. We feel flattered to reflect that all the universities of the three kingdoms, the naval and military colleges, the establishments and societies for the cultivation of learning, celestial and terrestrial, each with its scientific staff, and an immense offspring of prize-men and honour-men of all kinds, are yet unable to create a reading public sufficient to *support* a small mathematical periodical. There is, perhaps, no fairer test of the extent to which a science is cultivated in a country, than the number and circulation of the journals devoted to original matter thereon. Now if it be true, as I have been informed, that the *Mathematician* is discontinued, the number of our English journals is *one*—the *Camb. and Dub. Math. Journal* —whose eighteen annual octavo sheets, in addition to the pages of the imperishable 'Diary,' form the vent of the country's talent. Nor will it create the least surprise if this, too, were to become extinct; for it cannot live long by the favour of a few *scores* (*hundreds*, I fear, is hardly the right word) of subscribers at home and abroad. The natural consequence of this state of things is, that our best writers, who are equal to any in Europe, are continually sending their contributions to foreign journals. Yet, if any number of the scientific committees and societies of our Manchesters and Liverpools were to propose that they should place on their shelves, for use or ornament, the journals of *Crelle* or *Liouville*, which are rich in the contributions of British analysts, or even our own *Camb.* and *Dub. Math. Journal*, inferior to them only in extent and circulation, he would create no small merriment among his fellow philosophers. Was there ever seen one Number of any of the three periodicals mentioned on the table of any library or institution in the empire, not in a university town? Thus a Lancashire inquirer, living in the densest and wealthiest population of the globe, not in a seat of government, who may conceive the reasonable desire to look at the memoir of Mr. Cayley, to which reference has been made, or to obtain a glimpse of what the foremost mathematical investigators are doing, must, before he can attain his object, travel hundreds of miles!

"It may, perhaps, not be utterly unworthy of the attention of the next man of science who may undertake to draw up a 'Report of the Progress' for the British Association, to endeavour to estimate the *number*, without reference to attainment or reputation, of those who *pursue* or have *pursued* mathematical knowledge in this country from a genuine love of it, excluding those who merely undergo the interesting process of cramming for examinations, and distinguishing, on the one hand, those actual cultivators of the science who may be supposed to have derived their impulse as competitors in any way for honour and reward from our ancient seats of learning, and from the countenance of our Government, and, on the other, those who have drunk in their inspiration chiefly from the perennial fountain of the *Diary*. I confess it to be my belief, from a limited observation of graduates and non-graduates, that when the difference between the prizes awarded by the authorities on either side is considered, an incomparably greater share of the glory of kindling and cherishing a pure and lasting love of mathematical science in *men* as well as *boys*, must be attributed to the immortal Lady Di, than to all the universities and colleges of these kingdoms put together,—to all our Lyceums, Athenæums, and philosophical societies, and to all our imperial boards of peace and war."

*(To be continued in our next.)*

## MESSRS. COPE AND COLLINSON'S IMPROVED BRACKET FOR VENETIAN BLINDS.

[Registered under the Act for the Protection of Articles of Utility. Messrs. Cope and Collinson, of Summer-row, Birmingham, and 53, Berwick-street, Oxford-street, London, Brass Founders, Proprietors.]

Fig. 1. Fig. 2. Fig. 3.

Figs. 1 and 2 are front elevations of this bracket, showing the moving parts in different positions, and fig. 3 is a side elevation. A is the upper plate, by which it is screwed to the underside of the fixed lath instead of being placed on the upper side as heretofore; B is the centre, upon which the roller C turns; D, the over balance lever, which takes into the ratchet wheel upon the end of the roller, and E, a friction strap or lever, which serves, first (by pulling the cord F) to lift the lever D out of the ratchet wheel, by means of a cross bar, fig. 3, and thus to let the roller go free for the blind to descend, and then by continuing to pull the cord F to E, acts as a break upon the roller C, which prevents the sudden fall of the blind and consequent risk of breakage. *a* is a spring which causes the lever E to assume its proper position (when let go), so that the lever D may fall into the ratchet wheel.

Fig. 1 shows the position of the parts when the lever D is in action, and fig. 2 is a representation of the same

when the friction lever E is in action. G G are holes formed in the tail of the bracket, which serve as bearings for the axes H H of the top shade lath I. The manner of fitting the axis on the shade lath is shown at *h*, fig. 3.

## EXPERIMENTAL TRIP OF THE "PROPONTIS" SCREW STEAM-SHIP.

On Tuesday last the eighth vessel of the fleet of screw steamers belonging to the General Screw Steam Shipping Company made an experimental trip from Blackwall to the Lower Hope and back, under circumstances of an exceedingly gratifying character to all parties concerned. The keel of this vessel was laid down little more than three months since, by Messrs. Mare and Co., of Blackwall, at whose yard she has been constructed under the superintendence and from the design of Mr. Waterman, jun., of that firm. Her length between perpendiculars is 175 feet; extreme breadth, 25 feet; depth, 17 feet; and measurement, 560 tons.

The *Propontis* is a sister vessel of the *Hellespont* and the *Bosphorus*, and is intended to run between Liverpool and Constantinople. She has accommodation for twenty first-class passengers, and carries 360 tons of merchandize. The vessel is fitted with Messrs. Maudslay and Field's direct-acting engines—the screw being coupled directly with the shaft, without the intervention of wheel-work. She has two engines of 40-horses power, with cylinders of 36 inches in diameter and a two foot stroke, her estimated speed being 9¾ knots per hour, with an average at sea of 8½ knots. A large party of naval and scientific gentlemen were on board, among whom we noticed Mr. Laming, the Managing Director of the Company; Baron Moncorvo (son of His Excellency the Portuguese Minister); Captain Halsted, R.N.; Captain Warden, R.N.; Lieut. Diago Echapparre (of the Russian Imperial Service); Captain Ford (Superintendent of the Company's fleet); Mr. How (of the United States Navy); Captain Boxer, Captain Drayton, Captain Brenan, Mr. Maudslay, and Mr. Howell, the Secretary of the Company. The ship left the East India Docks at a quarter before one o'clock, and proceeded down the river with a favourable wind and a slack tide, at an average speed of 10¾ miles. Although the engines had never been tried previously, not the slightest mishap occurred in the run to the Lower Hope, which was made at a quarter before three o'clock. Here the vessel was brought round, and, with a head wind and a strong adverse tide, she worked gallantly back to Blackwall in little more than three hours,—her performance being pronounced, by those best competent to judge, almost unexampled, the power and the tonnage of the ship considered. The *Propontis* proceeds to Liverpool, and is under orders to sail from that port for Constantinople on the 25th inst. One interesting incident of the day should not be omitted. The *Propontis* had scarcely got under weigh, after leaving the dock, when she met her sister vessel, the *Hellespont*, in the river, homeward bound from her first voyage to Constantinople. The crews of both ships gave three hearty cheers as the vessels passed each other.

We may add, that among the nautical men on board, there seemed to be but one opinion as to the complete success and great superiority of the screw steam ships for the conveyance of passengers and merchandize. —*Morning Post.*

## THE SCREW PATENTS.

On Monday last a question of considerable interest, in respect to steam navigation, was argued before the Judicial Committee, at the Privy Council-office, Whitehall, Lords Brougham, Campbell, and Langsdale, Dr. Lushington, and Mr. Pemberton Leigh being present. An application was made by Sir Frederick Thesiger, on behalf of the patentees of the screw propeller, for an extension of their patent, which expires in May next. The evidence went to prove that no less than 30,000*l.* had been expended in building the *Archimedes* and in defraying other weighty charges to establish the screw-propulsion principle; and it further appeared, that although no less than 32 ships-of-war and 100 mercantile steam-vessels had been constructed already upon this system, not more than two or three had paid for the patent license. These evasions had been occasioned by the conflicting claims of five different patentees; but, as these have now united in one association, it is expected that all who have adopted the use of the screw-propeller will have to pay for their licenses. As the Admiralty are interested, either directly or collaterally, in this question to the amount of about 25,000*l.*, Sir John Jervis, the Attorney-General, assisted by Mr. Crowder, Q.C., opposed the application for an extension of Mr. Frank Pettit Smith's patent; but, after examining Captains Chappell and Crispen, R.N., and Messrs. Brunel and Galloway, engineers, their Lordships decided on granting an extension of five years to Mr. Smith's patent upon certain conditions.—*Times.*

### THE ROYAL AGRICULTURAL SOCIETY'S STEAM-ENGINE PRIZE.

Respected Friend,—Having observed in thy Magazine a few weeks since some correspondence on the subject of the Prize awarded to steam engines by the Royal Agricultural Society of England at their meeting at Norwich, and in which correspondence our names are prominently mentioned, and noticing the reply by R. Garrett, and thy own concluding remarks, we should not have thought it necessary to have offered any remarks upon the matter, but finding by a letter circulated by W. Baddeley, that the question is again revived, we think it due to ourselves to state, that we have not been in any respect, directly, or indirectly, parties to the controversy, nor until we saw it in print cognizant of the correspondence.

We hold a strong opinion,—which in all suitable places we have not hesitated to avow—of the impolicy of the system of prizes, and of the impossibility of arriving, by such tests, and in so limited time as can be afforded in so large public exhibitions, at a conclusion which should satisfactorily determine the relative merits of the engines, machines, or implements, so exhibited; but although we have not unfrequently doubted the soundness of the awards, we have never imputed, nor do we even suspect, the existence of corrupt motives, or attempts at trickery, either on the part of the judges, or of the successful competitors.

Thy insertion of this letter will oblige thine respectfully,

RANSOMES AND MAY.

Ipswich, 2 mo., 8, 1850.

### REPORT OF THE ROYAL COMMISSIONERS APPOINTED TO INQUIRE INTO THE APPLICATION OF IRON TO RAILWAY STRUCTURES.

(Concluded from page 110.)

The mean tensile strength of cast-iron derived from these experiments is 15,711 lbs. per square inch, and the ultimate extension $\frac{1}{600}$ of the length, and this weight would compress a bar of iron of the same section $\frac{1}{715}$ of its length. It must be observed, that the usual law is very nearly true for wrought-iron.

Many denominations of cast-iron have got into common use, of which the properties had not yet been ascertained with due precision. Seventeen kinds of them have been selected, and their tensile and crushing forces determined. Experiments have also been made upon the transverse strength and resistance of bars of wrought and cast iron acted upon by horizontal as well as vertical forces. These experiments will be found to exhibit very fully the deflections and sets of cast-iron, and the defect of its elasticity.

The bars which were experimented upon by transverse pressure, were of sections varying from 1 inch square to 3 inches square, and of various other sections, and the actual breaking weights show that the strength of a bar 1 inch square should not be taken as the unit for calculating the strength of a larger casting of similar metal, although the practice of doing so has been a prevalent one, for it appears that the crystals in the portion of the bar which cools first are small and close, whilst the central portion of bars 2 inches square and 3 inches square is composed of comparatively large crystals, and bars of 3 inches square in section planed down on all sides alike to $\frac{3}{4}$ths of an inch square, are found to be very weak to resist both transverse and crushing pressure. Hence it appears desirable in seeking for a unit for the strength of iron of which a large casting is to be made, that the bar used should equal in thickness the thickest part of the proposed casting.

The performance of these various experiments has been greatly facilitated by the permission which was liberally granted to us by the Lords Commissioners of the Admiralty, to make use of Portsmouth Dockyard in carrying on our investigations, in addition to which, however, we found it necessary to hire for several months some premises in Lambeth. This was found requisite for the performance of those portions of the experimental inquiry which had been undertaken by Eaton Hodgkinson, Esq. Although we are aware that, to point out the labours of individual members of the Commission would be impossible, and that it may appear invidious to single one out for praise, we cannot resist the expression of our thanks to the above-named gentleman for the zeal and intelligence with which he has carried out the remarkable series of experiments which are detailed in the Appendix to this Report, and which constitute a large proportion of those which have been already described.

In addition we have obtained, from many of the iron masters, information respecting the various processes employed by them in the manufacture of their irons, and the effect of such processes upon the strength and properties of the material produced: and we have also made careful inquiries of civil engineers with respect to the qualities and mixtures of iron preferred by them, for the large castings used in the construction of railway bridges, and to the respective pro-

perties of hot-blast and cold-blast iron: this investigation has been greatly facilitated by the liberality and candour with which these gentlemen have communicated to us the results of their experience.

As no map of the kingdom had been constructed representing the districts in which iron is found and worked, we applied to the officers of the Museum of Practical Geology for their assistance, and they caused one to be prepared expressly to accompany this Report, in which the principal furnaces now in blast are shown.

Great differences of opinion exist with respect to the best qualities and mixtures of iron; and, after all, it appears that those employed for large castings depend practically so much upon the commercial question of relative cost, that engineers are rarely able to select the very best material. It is generally admitted that engineers have no guarantee that the mixture for which they have stipulated in a contract shall be that used by the founder, and no certain test by which to determine whether a given piece of iron has been manufactured by hot or cold blast. A very good protection appears to be contained in the recommendation of Mr. Fox, that engineers in contracting for a number of girders, should stipulate that they should not break with less than a certain weight (leaving the mixture to the founder), and cause one more than the required number to be cast. The engineer may then select one to be broken, and, if it break with less weight than that agreed upon, the whole may be rejected.

At the beginning of the railway system the bridges were naturally constructed upon similar principles to those which had been already employed for common roads or aqueducts. Some of these ordinary constructions have proved inadequate to sustain the enormous loads and vibrations of railway trains. Some have been considered too expensive; others, as the suspension bridges, have been found wholly unfitted for railway purposes. Moreover, the necessity for preserving the level of a railroad as much as possible, combined with that of passing under or over existing canals, rivers, or roads, has created a demand for those forms of bridges which admit of being kept as low as possible, consistently with the proper headway or passage below; or, in other words, of making the least possible difference of level between the road or stream which the bridge has to carry and that which it has to cross.

From these causes, combined with the innumerable opportunities of building new bridges which the railways have given occasion to, and a constant endeavour to reduce the expense of building them, a variety of new constructions have been proposed and essayed, most of them of great merit and value, while others appear to be of very doubtful stability.

On the whole, the art of railway bridge-building cannot be said to be in that settled state which would enable an engineer to apply principles with confidence. We have therefore thought it our duty to inquire into the present methods of railway bridge-building, to collect in evidence the opinions and practice of the leading members of the profession of civil engineers upon this branch of construction, and especially with respect to the form and proportions of simple cast-iron girders, the practical limits to the employment of such girders, the methods of combining them with the rest of the structure, the various forms of compound girders, the expediency of several combinations of wrought-iron with cast-iron; and, finally, the comparative merits of plain girders, and of other forms in which the principles of the arch, or other methods of giving stiffness, are introduced.

The simplest bridge, and that which admits of the greatest possible headway at a given elevation, is, undoubtedly, the straight girder bridge.

The length of a simple cast-iron girder appears to be limited only by the power of making sound castings, and the difficulty of moving large masses. Thus the practical length has been variously stated to us as 40, 50, and 60 feet. The form resulting from Mr. Hodgkinson's former experiments on this subject is universally admitted to be that which gives the greatest strength; but the requirements of construction compel many variations from it, especially in the ratio between the top and bottom flanges. Moreover the convenience and the necessity of keeping the roadway for rails as low as possible has introduced a practice of supporting the beams which sustain the rails upon one side of the bottom flange. The pressure of the roadway and of the passing loads being thus thrown wholly on one side of the central vertical web of the girder produces torsion (which is not always taken into account in determining the proportions of the girder). The existence of this torsion is admitted on all hands, and various schemes are employed to counteract and diminish it; but the form of a girder that will effectually resist this disturbing force, without incurring other evils still remains a desideratum.

The requisite length of girders is increased considerably by the excessive use of skew bridges; and it is much to be regretted that difficulties should often be thrown in the way of altering the course of existing roads and canals when the line of a proposed railway happens to cross them at an acute

angle. Partly from these causes, and partly from a little indulgence in the pride of construction, skew bridges may be found, of which, from the obliquity of the bridge, the girders are more than double the length that would be required by the direct span of the opening to be crossed.

When the span of the opening or other circumstances render the use of single straight girders unadvisable, straight girders built up of several separate castings bolted together, and sometimes trussed with wrought-iron tension rods, are largely employed, and necessarily with great varieties of construction. By these means the girders may be extended to spans of upwards of 120 feet.

When wrought-iron is combined with cast-iron in the manner of trussing, several difficulties arise from the different expansions of the two metals and the difference of their masses, which causes the wrought-iron rods to be more rapidly affected by a sudden change of temperature than the cast-iron parts. The constant strain upon the wrought-iron tends to produce a permanent elongation, and hence tension rods may require to be occasionally screwed up. We have sought for opinions and information upon all these questions, and these show that the greatest skill and caution are necessary to insure the safe employment of such combinations. It is not admitted that the vibration of railway trains would loosen or injure the bolts or rivets of compound girders. Nevertheless, wood, felt, or other similar substances, have occasionally been introduced between surfaces to diminish the communication of vibration.

The general opinion of engineers appears to be that the cast-iron arch is the best form for an iron bridge when it can be selected without regard to expense or to the height above the river or road which is to be crossed. For low bridges the bowstring girder is recommended. Lattice bridges appear to be of doubtful merit.

The latest mode of construction that has been introduced consists of boiler plates riveted together as in iron ship-building, and combined in various ways with cast-iron. Hollow girders are thus formed, which are either made so large as to admit of the road and carriages passing through them,—as in the Conway and Britannia bridges; or else these tube girders are made on a smaller scale and employed in the same manner as the ordinary cast-iron girders, to sustain transverse joists which carry the road. The first kind is applicable to enormous spans, those of the two bridges above mentioned being 400 and 462 feet respectively. The second kind are said to be cheaper and more elastic than other forms for spans that exceed 40 feet. These methods appear to possess and to promise many advantages, but they are of such recent introduction that no experience has yet been acquired of their powers to resist the various actions of sudden changes of temperature, vibrations, and other causes of deterioration. We have thought it our duty to seek for information with respect to them, and we find engineers to be for the most part exceedingly favourable towards them; but, for the reasons above stated, we are unable to express any opinion upon them. At the same time we desire to bear testimony to the patient care and scientific manner in which the forms and proportions of the great tubes of the Conway and Britannia bridges have been elaborated: and we must beg to refer to the Minutes of Evidence for the details of the information which we have collected.

The investigation in which we have been concerned has made it evident that the novelty of the railway system has introduced a variety of new mechanical causes, the effects of which have not yet had time fully to develope themselves, on account of the extent and number of new railways, and the rapidity with which they were constructed, in many cases scarcely giving breathing time to the engineers, by which to observe and profit by the experience of each successive new construction. Thus it has happened that some portions of mechanism and structure have been made too weak, or placed in unfavorable combinations; and hence some unavoidable but most lamentable, and sometimes fatal accidents, have been occasioned. It also appears that there exists a great want of uniformity in practice in many most important matters relating to railway engineering, which shows how imperfect and deficient it yet is in leading principles.

But we have also observed throughout the present inquiry that the engineers have been already warned by experience of the necessity for increasing the strength of bridges employed in railways; and of watching more narrowly their construction, so as to render them as strong as possible. Accordingly we have found that the original structure of all those bridges which had shown the least signs of weakness, has been carefully altered and strengthened, so as to leave no apparent cause for apprehension; while in new bridges, better and stronger combinations are adopted.

And in conclusion, considering that the attention of engineers has been sufficiently awakened to the necessity of providing a superior abundant strength in railway structures, and also considering the great importance of leaving the genius of scientific men unfettered for the development of a subject as yet so novel and so rapidly progressive as the construction of

railways, we are of opinion that any legislative enactments with respect to the forms and proportions of the iron structures employed therein would be highly inexpedient.

We would, however, direct attention to the general conclusions we have arrived at from our own experiments and from the information supplied to us, namely,—

That it appears advisable for engineers in contracting for castings to stipulate for iron to bear a certain weight instead of endeavouring to procure a specified mixture.

That to calculate the strength of a particular iron for large castings the bars used as a unit should be equal in thickness to the thickest part of the proposed casting.

That, as it has been shown that to resist the effects of reiterated flexure iron should scarcely be allowed to suffer a deflection equal to one-third of its ultimate deflection, and since the deflection produced by a given load is increased by the effects of percussion, it is advisable that the greatest load in railway bridges should in no case exceed one-sixth of the weight which would break the beam when laid on at rest in the centre.

That as it has appeared that the effect of velocity communicated to a load is to increase the deflection that it would produce if set at rest upon the bridge, and also that dynamical increase in bridges of less than 40 feet in length is of sufficient importance to demand attention,—may even for lengths of 20 feet become more than one-half of the statical deflection at high velocities, but can be diminished by increasing the stiffness of the bridge,—it is advisable that, for short bridges especially, the increased deflection should be calculated from the greatest load and highest velocity to which the bridge may be liable; and that a weight which would statically produce the same deflection should, in estimating the strength of the structure, be considered as the greatest load to which the bridge is subject.

Lastly; the power of a beam to resist impact varies with the mass of the beam, the striking body being the same, and by increasing the inertia of the beam without adding to its strength the power to resist impact is within certain limits also increased. Hence it follows that weight is an important consideration in structures exposed to concussions.

Whilst, however, we lament that the limited means which have been placed at our disposal, and the great time required for such investigations, have compelled us to leave in an imperfect state, or even to neglect altogether, many interesting and important branches of experimental inquiry, we trust that the facts and opinions which we have been enabled to collect will serve to illustrate the action which takes place under varying circumstances in iron railway bridges, and enable the engineer and mechanic to apply the metal with more confidence than heretofore.

WROTTESLEY.
ROBERT WILLIS.
HENRY JAMES.
GEORGE RENNIE.
W. CUBITT.
EATON HODGKINSON.

DOUGLAS GALTON,
*Lieut. Royal Engineers, Secretary.*

Whitehall, July 26, 1849.

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### PARKINSON (OF BURY'S) PATENT IMPROVEMENTS IN MEASURING AND REGISTERING THE FLOW OF LIQUIDS.

The liquid meter specified under this patent, of which want of room prevented us from giving an account last week, consists of a tub-shaped vessel in halves, united at the centre by flanges, to which are attached the edges of an elastic bag. Upon the top of the vessel is a valve-box, into which water flows from the main, and which communicates with the top and with the bottom (by a vertical tube) alternately. Two curved plates are riveted together on either side of the elastic bag, and constitute a species of piston. A slide is placed in the valve-box which, as it is moved to and fro, establishes a communication between the main and the spaces above and beneath the piston, and also between them and the outflow pipe alternately. The valve is worked by a toothed segment, which is keyed on a spindle, which, passing through a stuffing-box in the valve-box, carries outside a plate with two teeth, into the space between which a projection on a tumbler lever works. The piston is connected by a chain to a rod, which slides in a stuffing-box in the top of the vessel, and carries at top a toothed rack, into which gears a pinion keyed upon a spindle which carries another pinion that gears into a horizontal rack, which is fitted with a lever having a click, that at every movement of the horizontal rack causes a ratchet wheel to make one-tenth of a revolution. This movement is communicated to a registering apparatus in the usual way. The horizontal rack is made to impart motion to the tumbler lever. Supposing the water to flow from the main, through the valve box, into the top of the vessel above the piston, which will thereby be gradually forced to the bottom of it, then the water which was beneath the piston will be forced out up the vertical pipe through the outflow, and when the piston has arrived

at the bottom it will draw the rod down, and by means of the connecting parts will raise the tumbler lever beyond the the perpendicular, when it will fall on the other side, and through the toothed segment, and gearing will reverse the position of the valve, upon which the water will descend through the vertical pipe into the bottom of the vessel, and force what water was above the piston through the outflow pipe. As the piston ascends it will gradually push the rod up, and thereby reverse the position of the valve. A modification of this meter is described, in which the elastic bag is replaced by a non-elastic piston.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 14TH, 1850.

JOHN KNOWLYS, Heysham Tower, near Lancaster, esquire. *For improvements in the application and combination of mineral and vegetable products; also in obtaining products from mineral and vegetable substances, and in the generation and application of heat.* Patent dated August 9, 1848.

The improvements sought to be secured under this patent relate chiefly to paints or pigments.

1. The patentee's first product is obtained by reducing silicate of manganese to powder, then grinding it up with oil. The result is a pigment of a light brown colour, which may be employed alone or mixed with peroxide of iron, oxide of zinc, or other colouring materials to give them tone and body. Or instead of the silicate of manganese, corundum, greystone, limestone, feldspar, blue clay, Kimeridge coal, jet, anthracite, any of the varieties of pyrites of iron, iron ores, the residuum of copper, antimony and arsenical ores reduced to a friable state, and similar mineral substances, may be employed. The grinding surfaces are made hollow and kept cold by the passage of cold water through them, and have a motion communicated to them similar to that employed in grinding glass.

2. To purify the crude oxides of zinc, which contain sulphur and other impurities, they are to be dissolved in sulphuric acid, and the solution allowed to stand until the impurities have settled, when the clear solution is decanted off, and a solution of carbonate of soda added to precipitate the zinc, which is dried and reconverted into oxide of zinc, when it is ready to be used as a paint or pigment. The sulphate solution is converted into the carbonate solution, and rendered again applicable. Hydrochloric, muriatic, or acetic acid, may be used instead of sulphuric acid. Or, instead of the preceding process, the crude oxide may be ground up with lime, or carbonate of lime, or carbonate of lime and magnesia combined.

3. It is proposed to employ the carbonaceous residuum from the manufacture of prussiates of soda and potash as a pigment, also as a manure, and deodorant. To render the residuum fit to be employed as a pigment, it is to be washed and ground up with oil. Or, muriatic acid is added to the residuum for the purpose of combining with the oxide of iron which it contains, and forming a salt of iron. It is then washed in water to carry off the saline and other impurities, and is ready for use. The resulting product is termed by the patentee "horn black," and may be employed as a black pigment, alone, or mixed with any of the substances before enumerated. The residuum may be used as manure, either as first obtained, or when deprived of its iron; and may be applied in its natural state to the deodorising of noxious substances.

4. To clarify and bleach linseed oil, &c., it is proposed to cause it to flow, in finely-divided streams, down a tower with glazed sides, and to encounter a current of air forced up in a contrary direction, so that it may be subjected to the action of light and air. The same apparatus, with the addition of steam pipes, may be applied to the evaporation and concentration of syrups and saccharine solutions. Or, instead of steam, cold water may be caused to flow through the pipes, and the apparatus be then applied to cooling heated liquids.

5. The last improvement refers to certain steam-boiler furnaces, which were the subject of a former patent granted to Mr. Knowlys, and consists in causing the flues of two furnaces, placed on either side of the boiler, to descend, and then turn up and open into a tube, placed concentrically, and within the boiler, which leads to the chimney.

*Claims.*—1. The mode described of grinding colours.

2. The application of the various substances enumerated under the first head of the specification, either alone or combined with ordinary colouring materials, as paints or pigments.

3. The mode of purifying the crude oxides of zinc by the process above described.

4. The employment with the crude oxides of zinc of lime, of carbonate of lime, or carbonates of lime and manganese, combined, for the purpose of rendering them fit for being used with paints or pigments.

5. The application of the carbonaceous residuum obtained in the manufacture of prussiates of potash and soda, when treated as described, either alone or combined with other materials, as a paint or pigment.

6. The application of the said residuum

either when in its natural state, or when deprived of its iron as a manure.

7. The application of this residuum, in its natural state, to the deodorizing of noxious substances.

8. The employment of the apparatuses for the clarifying and bleaching linseed and other oils and fats, for evaporating and concentrating syrups and saccharine solutions, and for cooling liquids.

9. The use and application of a pyrometer attached to the subliming vessel. [A cover is placed on the vessel, so as to leave an air-space between the two, to prevent too great a radiation of heat; and the heat of the exterior of the vessel will be indicated by a pyrometer on a dial in the usual way.]

We could not discover in any portion of the specification even the word "pyrometer," much less a description of it, unless it be the concluding part of the claim, which we have put between brackets, and is so unintelligible that it may be taken either as referring to the pyrometer or the arrangement described under the fifth head of the specification.

William Thomas, Cheapside, merchant, and John Marsh, foreman to the said William Thomas. *For improvements in the manufacture of looped fabrics, stays, and other parts of dress; also an apparatus for measuring.* Patent dated August 9, 1849.

The patentees describe and claim—

1. A machine for making looped fabrics, as described, constructed generally on the same principle as the well-known circular weaving loom (tricoteur) of the late Sir M. I. Brunel, but varying in the details. There is a circular plate, which is made to rotate by hand through the intervention of suitable toothed gearing, the periphery of which plate carries a number of needles. Above them, at one point of the frame, there is a cylinder, having on the inner end a toothed wheel, which gears into the spaces between the fixed ends of the needles, while the other end of the cylinder is furnished with plates which penetrate into spaces between the needles, near the beards, and force down the thread, which is fed under it by an eye, as usual, and is to form the loops.

The rotation of the circular plate imparts, by means of the needles and toothed wheel, a rotary motion to the cylinder and plates, whereby the loops are successively formed, and then carried to a point where the pressing and knocking off are effected, by means of a presser wheel above the needles, which closes up the loops, while a wheel underneath them knocks the work off over the beards of the needles on to the new loops. A plate is provided for keeping the work off the beards previously to its being acted on by the presser wheel. When it is desired to introduce an ornamental or weft thread, the patentees use a pattern roller and guide; the roller being caused to act on the needles in such manner that some of them are raised while the rest remain stationary, and the thread passed over or under them accordingly. Two brush rollers are also used, and made to rotate towards the centre of the plate, so as to sweep the weft from the beards on to the work.

2. To manufacture stay cloth, or fabrics which have to be widened or narrowed, it is proposed to construct the reed in several parts, and to remove each piece separately out of the way, care being taken to cut that portion of the warp which passes through the part of the reed to be removed, and knot it behind, and which is to be returned to its place, and the warp joined to the work as the fabric is to be widened.

3. It is proposed to manufacture stay cloth by weaving two fabrics at the same time, and uniting them in certain parts by means of stitching warp, with the exception of where bones are to be introduced. And also to throw in additional weft or wadding between the fabrics, which is securely held by the stitching warp.

4. For ornamenting stay fabrics, a silk thread is to be introduced, and the fabric woven in such manner that it may appear upon the upper or under side according to the pattern to be produced.

5. An improvement in the apparatus for tambour-stitching, described vol. L., p. 114, is next specified, which consists in giving a to and fro, as well as a sideway motion to the thread carrier, for the purpose of passing the thread over the hook, by means of a system of levers actuated by cams on the main rotary shaft.

6. As a substitute for ladies' hoops, the patentees suggest the employment of hollow pieces of wood, threaded on a cord of elastic material; or the wood may be solid, and united at the ends by some suitable elastic fabric.

7. Instead of padding to improve the bust, a fabric composed of bristles or bones, and blocked into the required shape, is to be used.

8. To manufacture moreen to be used for crinoline, bristles, or other stiff materials, are to be introduced during the operation of weaving, or into spaces left for that purpose in the fabric.

9. The improved fastenings consist of a number of clips, attached to a piece of tape, which embrace two cords stitched in the opposite edges of the stays or articles of dress respectively, so that as the clips are slidden up or down, the stays, &c., will be fastened or unfastened accordingly.

John Ruthven, Edinburgh, C.E. *For*

*improvements in propelling and navigating ships, vessels, or boats, by steam or other powers.* (A communication.) Patent dated August 10, 1849.

The subject of this patent is a scheme for submarine propelling, which may be considered as an improvement on that which was brought forward some years ago by Mr. Ruthven, and failed.

*Claims.*—1. The combination of a centrifugal pump and curved plates, whereby the water is drawn in, raised, and ejected, as described.

2. The affixing of moveable nozzles on the stationary pipes, which may be moved in a vertical plane either fore or aft, or up or down, whereby the direction of the vessel will be changed, or its progress stopped, without the use of the valves.

WILLIAM FURNESS, Lawton-street, Liverpool, builder. *For improvements in machinery for cutting, turning, planing, moulding, dovetailing, boring, mortising, tongueing, grooving, and sawing wood; also for sharpening and grinding tools or surfaces; and also in welding steel to cast iron.* Patent dated August 9, 1849.

The patentee describes an ingenious arrangement and construction of machinery for effecting the different operations enumerated in the title of the patent, but of which no intelligible notion can be conveyed without the help of engravings. The improvement in welding cast iron to steel, consists in placing the heated steel in a mould, and pouring the melted cast iron upon it—due precaution being taken for the escape of the surplus molten metal. Or, the steel may be first covered with powdered borax. (The latter part of Mr. Furness's invention has been already patented by Mr. Perlbach. (See *Mech. Mag.*, vol. xlviii., p. 113.)

ARTHUR HOWE HOLDSWORTH, of the Beacon, Dartmouth, Esq. *For improvements in the construction of marine steam boilers and funnels of steam-boats and vessels.* Patent dated August 9, 1849.

The object of this invention is to render steam vessels less liable to accidents from fire than at present, and also to prevent the injurious effects to the health of firemen, arising from the deterioration of the air which they breathe, by its coming in contact with iron heated by the direct action of fire. With these views—

1. The portion of the funnel beneath the upper deck is surrounded with a casing, and water is made to flow into the space thus formed between the two, at bottom from a reservoir, which is filled by the action of the paddles. An outflow pipe is adapted to the top of the space for the escape of the surplus water.

2. The screens to the fire-doors are constructed of iron plates, so as to have a hollow interior, into which water is supplied from the steam boiler by means of hollow hinges or pipes, and then returns to the boiler through similar channels.

*Claims.*—1. Arranging smoke-box or fire-doors, or screen-doors to fire-doors, in marine steam boilers, so that water may circulate therein.

2. The circulation of water in spaces within casings to the funnels to marine steam boilers.

[If the reader will refer to the specification of Messrs. Lamb and Sumners, vol. L., p. 553, he will find some arrangements very similar to the preceding.]

ALFRED VINCENT NEWTON, Chancery-lane. *For improvements in derricks for raising heavy bodies.* (A communication.) Patent dated August 9, 1849.

This improved derrick has a boom which projects from either side of the mast, instead of from one side only, as has hitherto been customary, which is supported, and free to turn in suitable bearings, on the top of a triangular pyramidal frame, which is composed of three standards united and strengthened by diagonal braces and cross-ties. These braces and ties are made to overlap one another in such manner, that the same bolt serves to retain two of them in position. The lower part of the frame is connected to a circular frame, having a rail on the under face, on which travel two friction rollers, which are put in motion by means of a toothed pinion gearing into teeth cut on portions of their peripheries. The outer ends of the axles of the friction wheels are united by a band, which is connected by a trace-rod to the rear end of the boom, and serves as a bearing for the pinion, while the inner ends are turned up and fitted with smaller friction wheels, which bear against the inner edge of the circular frame, whereby the strain is transferred, through the intervention of the brace-rod, from the boom, in a vertical and horizontal direction, to the frame. The boom is made to swing round in any required direction by the friction wheels being made to travel round the circular frame. To facilitate the removal of the derrick from place to place along the works, rollers are fitted to the lower part of the frame, and arranged so that two of the standards shall rest upon one of a line of rails, and the third standard upon the other. The fore end of the boom is constructed of two pieces of timber, which, embracing the mast, are secured to the rear end, and have sufficient space between them to allow of a block sliding to and fro. The block carries a pulley, over which passes the

rope used for hoisting, and then over a second pulley, down through the lower part of the mast, which is made hollow for that purpose, round the barrel of the windlass. Two smaller ropes are attached to the fore and aft ends of the block, the one passing over a pulley in the extremity of the boom, and then, together with the other, over the pulley in the mast, for the purpose of causing it to travel to and fro upon the boom. The boom is stayed by braces attached to a plate on the mast-head; those which support the fore-end of the boom being made to branch out on both sides of it to give free passage to the ropes.

*Claim.*—The construction and arrangement of parts constituting the improved derrick.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Louis Jean Jacques Viscount de Serionne, of Paris, for certain improvements in the manufacture of buttons, and in the apparatus and machinery used therein. February 9; six months.

Bryan Donkin the younger, of Bermondsey, Surrey, civil engineer, and Barnard William Farey, of Old Kent-road, in the said county, civil engineer, for improvements in steam engines, and an improved fluid meter. February 9; six months.

Read Holliday, of Huddersfield, for improvements in lamps. February 11; six months.

William Blinkhorn, of Sutton, Lancashire, glass manufacturer, for certain improvements in machinery to be used in the manufacture of glass. February 11; six months.

James Webster, of Leicester, engineer, for improvements in the production of gas for the purposes of light. February 12; six months.

John Macintosh, of Berners-street, Oxford-street, Middlesex, civil engineer, for improvements in obtaining power, in the floating of bodies, and in conveying fluids. February 12; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Feb. 8 | 2177 | Louis Rodolph Bodmer | Manchester | Door spring. |
| ,, | 2178 | Martin, Baskett, and Martin | Cheltenham | Porte-fleur brooch. |
| 9 | 2179 | Cope and Collinson | Birmingham, & Berwick-street, London | Bracket for Venetian blinds. |
| ,, | 2180 | John Lingard | Sheffield | Pocket knife. |
| ,, | 2181 | Scott and Thompson | Upper Ground-street, Blackfriars | Ladle for pouring melted metallic and other substances. |
| 11 | 2182 | W. Kidston and Co. | Bishopsgate-street, Without | An instrument for drawing blood. |
| 12 | 2183 | Wm. Brooksby Crabb. | Motcomb-street, Belgrave-sqr., | Accelero clasp. |
| ,, | 2184 | John St. Quentin | Norwich | Water closet. |
| ,, | 2185 | J. J. Wilson | Arundel-place, Haymarket | Brush. |
| 13 | 2186 | Enoch Oldfield Tindall and Lorenzo Tindall | Scarborough | Imperial mangle and wringing machine, with horizontal spring pressure. |

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1385.] SATURDAY, FEBRUARY 23, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## BROOMAN'S PATENT SUGAR DEPURATING AND MOULDING APPARATUS.

Fig. 1.

BROOMAN'S PATENT SUGAR DEPURATING AND MOULDING APPARATUS.

(Patent dated August 16, 1842. Specification enrolled February 16, 1850.)

The improvements embraced in this patent (communicated to the patentee from abroad) have mostly reference to the machine commonly known by the name of the "Hydro Extractor," which acts by centrifugal agency, or to modifications of that machine, in order to adapt it to other purposes than drying.

*First.* A mode is described of close-steaming goods while undergoing the centrifugal expelling process. The revolving vessel is made of two concentric cylinders, between which the steam is admitted, and so confined as to act inwards upon the goods.

*Second.* A very ingenious method follows of working a pair of centrifugal machines, according to which the power which is accumulated in the working of one machine is transferred, when at its maximum, to work or assist in working the other machine.

*Third.* An improved method of discharging or unloading centrifugal-acting machines.

*Fourth.* An improved construction of cylinder for such machines.

*Fifth.* An improved mode of fixing wire-gauze strainers, when such are employed.

*Sixth.* A method of forming or moulding substances, and also, when required, of depurating them at one and the same time. We give at length the details of this method, which is remarkable for its novelty, and likely, in its application to sugar, to be of more than ordinary importance:—

"Fig. 1 is a vertical section, and fig. 2 a plan of an apparatus suitable for applying this part of the invention to the manufacture of sugar. B is a cylindrical receiver, open at top and closed at bottom, into which the sugar is conveyed; $b^4$ $b^4$ are mouth pieces in the sides of this receiver, which open into and support at their small ends a series of sugar forms or moulds D D, which are disposed round the cylindrical receiver with their broad ends outermost. The receiver turns at bottom in a step $B^2$, and at top in a bearing $B^3$. C is a drum, which is fastened at the top and bottom to the outside of the receiver B, and has openings $C^1$ $C^1$, in which the larger ends of the forms rest. The openings $C^1C^1$ are made a little larger at the top, to allow the forms to enter and the projection $D^3$ to fall into one of the rings E. E E are a series of rings of T or angle-shaped iron, held in their places by brackets $E^1$ fastened to the drum C, each ring holding a row of forms D D firm, and preventing their moving outwards. The forms D D have at their larger ends two lids, an outer and an inner. The outer lid $D^1$ is solid, and entirely closes the opening in the end of the form when screwed up against the inner lid $D^2$ by nuts $D^4$ $D^4$. The inner lid is formed of a suitable metal framework, covered with wire gauze, and fits into a recess in the forms D D; it has a round piece of metal $d^3$ projecting from it, which passes through the outer lid $D^1$ and reaches the ring E, which thus holds it tight upon the form. The entire framework of this apparatus consists of a bottom F, of the shape shown, to which a strong frame $F^1$ is fixed, carrying the bearing $B^3$, and of two moveable sheets of iron $F^3$ $F^3$, which are placed in recesses on the form $F^1$, and thus form, along with the frame $F^1$, a casing to inclose the apparatus. C is a pulley connected with differential cones, which, in work, gradually increases the speed of the machine. $G^1$ is a pipe for conducting the crystallized sugar into the machine, and $F^2$ a pipe by which the purifying liquor ejected out of the form, as afterwards explained, is carried off. The mode of working the machine is as follows:—The forms D D and casings $F^3$ $F^3$ being put in their places, and the lids $D^1$ $D^1$ screwed up tight, the sugar, in a suitable state, is brought through the pipe $G^1$ to the receiver B. On motion being given to the machine, the sugar is forced into the forms by centrifugal power. The machine is kept at a slow motion until the mass is set. The lids $D^1$ $D^1$ are then loosened, by slackening the nuts $D^4$, to give passage to the liquid expelled from the forms. The machine is caused to revolve at a speed suitable to the condition of the sugar to be purified; and as soon as the syrup contained in the sugar in the forms has been thrown off, a proper quantity of the liquor used for purifying is poured into the receiver B, which, by

the centrifugal power, is equally distributed among the forms, and caused to pass through the sugar. The latter operation is repeated until the sugar is sufficiently purified, when the moulds can be taken out and the sugar removed."

*Seventh.* The substances, instead of being moulded and depurated by the centrifugal action of the machine, may be first formed in moulds, and then depurated only.

The *Eighth* and *Ninth* heads of the specification embrace modifications of the methods described under the sixth and seventh.

The *Ninth* specifies a mode of depurating liquids or substances by the combined action of steam and centrifugal agency.

The *Tenth*, a like mode of depuration, by the combination of gas and centrifugal agency.

*Eleventh.* An improved centrifugal filtre-bag. And,

*Twelfth* and *Thirteenth.* An apparatus for drying and evaporating; a detailed description of which we reserve for our next.

### THE ELECTRIC TELEGRAPH.—MR. BAIN—MR. BAKEWELL.

Sir,—As you inserted last week a communication from Mr. Bain, not only denying the novelty of my copying telegraph, but containing personal charges against me, I trust to your sense of justice for the insertion of this reply.

The substantial questions in dispute between Mr. Bain and myself are these: —First, is my copying telegraph an infringement of his patent for copying types? Second, have I taken unfair advantage of the opportunities I had of seeing his experiments for perfecting the dotting telegraph patented in 1847?

The only resemblance between my copying telegraph and Mr. Bain's of 1843, is, that in both a single marking point passes several times over different parts of the same line of letters. To carry out his invention, as described in the specification, the message must be set up in metal types, which are then to be pressed against a surface composed of the ends of fine insulated wires, disposed like the hairs in a brush. A metal style fixed to a pendulum passes to and fro across the other surface of the insulated wires, arrangements being made for the wire surface to descend in a slight degree at each vibration, so that the style may pass over a different part each time. The receiving instrument is similar, with the exception that a flat surface of moistened and chemically-prepared paper is substituted for the brush of wires, on which paper marks are made by electro-chemical decomposition whenever the electric circuit is completed, by the transmitting style pressing against any of the wires in contact with the metal types. In my copying telegraph, the message is written with varnish on tin-foil, which is placed round a cylinder wherever a metal style presses, which is carried gradually by a traversing net from end to end of the cylinder as it revolves. The paper to receive the message is also placed round a cylinder, and whenever the style on the transmitting cylinder presses on the tin-foil, the electric circuit is completed, and a mark is made, blanks being left wherever the point passes over the varnish writing. It is true, that if Mr. Bain had thought of writing on tin-foil, he might, by pressing it against the flat surface of insulated wires, have copied writing as well as metal types; but it is very evident that he did not think of it, or he would not have adopted the tedious mode of setting the message up in type before it was transmitted, instead of applying the written message itself to the instrument. In that case, too, the intermediate brush of wires might be dispensed with; for the only object of it is to present a level surface for the style to pass over.

There is this very important difference between Mr. Bain's copying telegraph of 1843 and mine:—His never did and never can produce legible copies of types or of writing on separate instruments. It is essential that each of the corresponding and distant pendulums should vibrate exactly together in every part of their paths, and as both would be connected with styles pressing against rough and different surfaces, they would become irregular at the first beat. A distinguishing feature of my invention is, the

production of synchronous movements in separate instruments by electro-magnetic regulators, which are brought into action independently of each other by a half-seconds' pendulum at each station. Another feature of my invention is, the employment of a "guide line" on the transmitting instrument, by means of which the distant operator can tell, to the thousandth part of a second, whether there be a variation in the beat of the two pendulums, and he is thus enabled to correct them.

It will be seen by Mr. Bain's description and drawings of what he terms his "patent copying telegraph in its present improved state," that scarcely anything of the original invention remains. For the metal types, writing on tinfoil is substituted; the brush of wires is abandoned; the movement of the metal styles by pendulums has disappeared; and the flat transmitting and receiving surfaces are converted into rotating cylinders. In the specification of Mr. Bain's invention, the only claim made in reference to the telegraph is, "the arrangement for copying surfaces by means of electricity,—described and shown in sheet 6." Nothing like that arrangement exists in the "improved" telegraph, which is, in fact, a distinct invention, not secured by patent, and is remarkable for its close imitation of mine, of which I consider it a direct infringement. In trying to avoid too great an appearance of similarity, Mr. Bain has in several instances introduced complex mechanism for effecting the simplest purposes. The whole mechanism of my copying telegraph consists of a train of four wheels.

I now come to Mr. Bain's charge, that I took undue advantage of his confidence. No accusation could be more unwarranted. I was, indeed, frequently with Mr. Bain when he was endeavouring to perfect his dotting telegraph; but the patent had then been specified and sold to the Electric Telegraph Company. Nearly all the experiments I saw had for their objects to facilitate the perforation of the paper, and to obtain clear and well-defined marks by electro-chemical decomposition. The only part of the experiments I could have turned to account in my invention was the latter; but I employ solutions different from any Mr. Bain then used.

Nothing in Mr. Bain's statements surprises me more than his assertion, that I discontinued my visits without disclosing the nature of my improvements. On the contrary, very shortly after the idea of the copying telegraph suggested itself to me, I mentioned it to him, and exhibited a specimen of the form in which the letters would appear. He then informed me that he had secured copying of all kinds by his patent of 1843, though he had not been able to do it. He offered to give me 500*l.* if I could accomplish it, and he proposed that I should tell him my plan. Having full confidence in him, I disclosed the mode by which I proposed to copy writing; when he asserted that it was his own plan, and retracted his offer. After some remonstrance on my part, he said he would give me the 500*l.* if I succeeded within a fortnight; though he stated, and repeated again and again, that the difficulty of making two distant instruments to go together could not be overcome in any manner. On the following day, I lodged a sealed paper, containing the substance of my disclosure to Mr. Bain, in the hands of a gentleman, who still retains it.

My application for a patent was opposed by the Electric Telegraph Company, and by Mr. Brett, and a notice of opposition was entered on behalf of Mr. Bain, but withdrawn. The Electric Telegraph Company (the possessors of all Mr. Bain's telegraph patents) did not allege that my copying telegraph, the nature of which I had divulged to them, was an infringement. They very fairly told the Attorney-General that I had disclosed to them, in confidence, my invention, therefore they did not oppose the copying process. Does Mr. Bain wish it to be understood that, had he been in England, he would have acted differently?

There are several other misstatements in Mr. Bain's communication; but I fear I have already occupied too much of your valuable space.

I am, Sir, yours, &c.,

F. C. Bakewell.

Hampstead, Feb. 14, 1850.

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## On an "Additional Memoir" of Emerson the Mathematician.

Sir,—The following letter containing some additional memorials of Emerson has been put into our hands by an esteemed

friend, with an intimation that it ought to be published; and conceiving that we could not better fulfil the wishes of the original possessor of the document than by forwarding it for insertion in the *Mechanics' Magazine*, we have seized the opportunity to make a few remarks on the subjects to which it relates, and beg to offer the communication for your acceptance. It will be seen that the memoir was first published in the *York Chronicle*, but the copy now before us is in manuscript, and was addressed by the Rev. William Bowe, of Scorton, near Catterick, in Yorkshire, to Mr., afterwards Sir John, Byerley, formerly of Stockton-on-Tees, an able contributor, both in his own name and under several fictitious signatures, to various mathematical and philosophical periodicals of his time, and who appears to have contemplated the publication of a new edition of the whole or part of Emerson's works, to which it was intended to append more copious particulars of the life and character of this extraordinary man than had hitherto been given. The allusion to a "*former* narrative" we at one time understood to refer to an earlier portion of the additional particulars either published in the *York Chronicle* or furnished to Mr. Byerley, but subsequent consideration has satisfied us that the reference is really intended to apply to the memoir presently noticed; though, from the somewhat abrupt termination of the narrative, it may readily be inferred that the writer intended to add something more on the subject, and that this is merely a short selection from the materials in his possession. No one, however, who has read the "most amusing life" of Emerson, as related by his personal friend and admirer, the Rev. William Bowe, prefixed to the collected edition of Emerson's works (1791), and also to his new edition of the "Tracts" (1793), will for a moment doubt the *literal* truth of the following additional sketch of his *personal* character from the same graphic pen; though perhaps there are many who would *now* demur to the estimate formed of the excellence and utility of many of his mathematical publications. It has been asserted, by no mean judge, that Emerson's works, "*except those of Simpson*, were, till a comparatively recent time, the very best in our language;" and though this is undoubtedly true in a certain sense, and may be considered as saying a great deal in favour of an author, yet when we consider the paucity of mathematical works in those times, it does not necessarily follow that the works themselves are of a high and lasting character, or that the author has succeeded in digesting his subjects in the most desirable or methodical manner. Such, indeed, is not by any means the case, as will be abundantly evident to any one who will take the trouble to examine the whole or any considerable portion of the *Cyclomathesis*. This is obviously the opinion of the writer just quoted; for he adds, "that a considerable number of Emerson's processes are marked with peculiar elegance and considerable powers of invention; still there is apparent in all of them a want of that power of generalization which distinguishes the highest order of minds. His 'Method of Increments' is the most original of his works; and his 'Doctrine of Fluxions' is perhaps the most elegant. His 'Mechanics' is the work by which he is most generally known—a circumstance probably owing to its containing descriptions of so many of the most usual and useful machines; but it is a work singularly crude and ill-digested, and not less singularly incomplete in even the enunciation of the most important principles of mechanical science."—*Penny Cyclop., art., Emerson.* In addition to what is above stated, we would respectfully submit, that a more close examination of many of Emerson's other publications would have compelled the writer to include them in the same category. His "*Geometry*" owes its chief, and, indeed, *only* value to the many curious and occasionally useful *results* which it contains, but considered as a *system* of geometry, it will admit of no comparison with the original edition of "Simpson's Euclid," or the excellent and valuable compilation of his talented opponent, the Woolwich Professor, of whom it has been truly remarked, that he *has been* as much *under* as Emerson has been *over*-rated. Of the "Treatise of Algebra" still less can be said in its favour, since its execution confessedly falls far below that of several of its predecessors, amongst which may be enumerated the treatises by Newton, Maclaurin, and Simpson. Were it not for the "great

variety of problems in the most important branches of mathematics" contained in Book ii., many of which are capable of being exhibited in a less objectionable form, the work would long since have been forgotten even by the most curious in such matters. An impartial, though laconic, estimate of Emerson's Fluxions has been given in the preceding extract, as has also a somewhat condemnatory, but literally just opinion of the most noted of his works, the "Treatise of Mechanics." With respect to the latter, it may be observed, that although "Old Emerson is, or was, the oracle of the practical people who make any pretensions to a step in science beyond the 'rule of thumb,'" yet his Mechanics is indeed a poor performance even for the time when it first appeared. Its *logic*, like Emerson's logic in geometry, so laconically exposed by Dr. Simpson in his letter to Nourse (*Geometry and Geometers*, No. 3), is often only fallacy disguised, and its principles stop short at the really difficult and most desirable parts of the subject. His applications, too, are not always of the most novel or satisfactory description, and although they have frequently been praised for their ingenuity and practical utility, it would be no easy task to attempt an illustration to any extent of either of these qualifications. So far as the "Comment on the Principia" is concerned, nothing was added to Emerson's fame on its account, unless it be an increase to his already unenviable notoriety, for the free and unscrupulous application of abusive epithets to those who happened to differ in opinion, either from himself or the authors whose writings he undertook to defend. Were it either necessary or desirable, we might run the gauntlet through the rest of Emerson's publications without much risk of personal injury or any great fear of sustaining much detriment to whatever modicum of literary reputation we may happen to possess; but enough has already been done to show that we are disposed to insist upon some slight modifications of the Rev. W. Bowe's opinions respecting Emerson's scientific merit; and whilst we award the reverend gentleman every credit for candour and honesty, we will conclude by remarking, that a *personal* friend and admirer is not exactly the sort of critic one would desire to form an estimate of an author's character, or pronounce a final dictum on the merits of his publications:—

Scorton, February 2, 1802.

Sir,—I have been much from home during our vacation this Christmas, and the only copy of any memoir of Emerson, with the additional narrative below, was in the hands of a friend at some distance, who did not return it till the other day. These circumstances must form my apology for not giving a more early reply to your favour. You are certainly at liberty to make what proper use you choose of the memoir, with these additional ones. I think I have some few more, and if I can find them, you shall be very welcome to them, if you desire to have them; but I apprehend you will have materials enough of that kind. I wish you most sincerely every success in your undertaking, and if in the course of it you think proper to favour me with any communications, I shall think myself obliged.

I am, Sir, your very obedient servant,
WILLIAM BOWE.

John Byerley, Esq.

*The Reaper.*

(Published in the *York Chronicle.*)

*Additional Memoir of the Life of Emerson, omitted in a former Narrative.*

Emerson's "Cyclomathesis"* is generally allowed to be the best, and most complete, that has ever been published in our, or perhaps in any language. It labours however under considerable defects, and is a work of unequal execution. It is, in some parts of it, too concise to be clear. In some few others it might be abridged, without any disadvantage to the subject. This last I would be understood to observe is but rarely the fault of Emerson. If he leaves his subject obscure, it is by being too sparing of his words and explanations, and not by writing *about it and about it*. Though he modestly professes to write for the information of young mathematicians, yet he frequently appears to forget this declaration, and to suppose that his reader will be able to follow his steps where he makes very gigantic strides indeed. The writer of this memoir once took an opportunity of intimating this to him, and ventured to recommend a concluding volume, as a kind of *Key to his Cyclomathesis*, observing that a moderate octavo might be made to comprise a full and parti-

* London, 1791. William Emerson: "Cyclomathesis, or an easy Introduction to the several branches of the Mathematics." *Octavo.* These are Emerson's works, collected (not reprinted) in thirteen volumes, with new title-pages.—*De Morgan's Arith., Book i.*, p. 78.

cular solution of all those theorems or problems which had generally been found difficult by mathematical students; and demonstrations, or farther elucidations of such lemmas or corollaries whose connection with their respective subject, or immediate deduction from it, was sometimes not clearly perceived by less intelligent minds. He replied with his usual bluntness, he would build no *Pontes Asinorum*, no *bridges for the accommodation of asses*, he had something else to do. He was then reminded that to elucidate, and make plain and easy, what had been left in intricacy and obscurity by others, appeared to be his professed intention, and, if one might judge from the motto in his title-page, was the object which he had principally in view:—

"Scribere laus magna est; sed scriptis addere lucem,
Hoc vero egregie dexteritatis opus."

(To write is very laudable; but to diffuse light over what has been written, is indeed an undertaking that requires more than common skill.)

This attempt to argue with, and confute him out of his own mouth appeared to nettle him a little, and he interrupted with some degree of tartness, "What I have written is intelligible enough to any man who has a competent stock of brains, and I see not the use of writing books for fellows who have little or no brains at all." Though Emerson had certainly nothing of the spirit of poetry about him, yet he sometimes imagined he possessed some little taste in that way, and on the strength of this idea borrowed of a friend the poems of Vincent Bourne. Upon returning the book some few days after, he (Emerson) observed that the author had made a mistake, or rather the printer, for, added he, "they are a set of idle, careless rascals, and there is no trusting them out of one's sight." This mistake was but a single letter, but as it made no sense as it stood, he had taken the liberty to put it to rights. His friend thanked him for doing so, but was curious to know what the mistake might be:—Emerson readily turned to the place in the poem entitled "Tweedside:"—

"And we'll lodge in some village on Tweed
And *love* where the feathered folks sing."

"'*Love* where the feathered folks sing!'" exclaimed Emerson, "that is nonsense; it should be, *live* where the feathered folks sing, to be sure." His friend could not refrain from smiling at this specimen of his critical acumen, and seeing him in a tolerable good-humour, desired to have his pen to make a short note, which he did in these words.

"N.B. This very curious correction was made by the very eminent mathematician Mr. Wm. Emerson of Hurworth; so just is the old caution—

'Ne sutor ultra crepidam.'"

Whatever knowledge he might possess of his own language, it is pretty clear that the *orthography* of it was by no means his forte. His oracle for the spelling of his words was *Old Bailey*, whose dictionary he consulted occasionally, when he found himself at a loss. But it seems he was far from thinking his oracle an infallible one, for in a vacant page in the beginning of the book, there occurs, in his own hand-writing, "A List of Words Omitted in this Book." In this list is the word *cockscomb*. I turned to the letter C and found "coxcomb" in its due place, but not spelled as it seems Emerson expected it should have been. It is highly probable Mr. Nourse his bookseller, or some other friend, might be aiding and assisting to him in the orthography of his words, and sometimes in the structure and arrangement of his sentences, but the general matter and turn of thought and expression are most undoubtedly his own. Though Emerson was a warm disputant; yet when he happened to meet with an antagonist, who reasoned with any tolerable degree of acuteness, he could bear with opposition, and would take great pains to confute and set him right; but when he found himself engaged with an opponent, who had no just claim to precision in argumentation, or knowledge of the subject, he was too apt to lose his patience, and was only solicitous *to knock him down*. Upon such occasions, *fool*, *blockhead*, *numscull*, were epithets which he bestowed very liberally. Sometimes he was not unsuccessful in a dry and sarcastic rebuke. He found himself once engaged at Darlington with a disputant of the last description. The man, it seems, who entertained no contemptible opinion of the furniture, of the *inside* of his head, had taken care to decorate the *outside* with a large, bushy, white wig; and eager to enter the lists with so renowned a champion, had sought him out at his public house, and found him engaged with two or three friends over a mutton chop. The contest soon commenced, and Emerson threw down his knife and fork, saying "I'll soon see what thou hast got in that head of thine." The dispute grew warm, and Emerson finding the man bewildered and attempting to make up by emphasis and solemnity of phrase what he wanted in argument, threw back his head and extending his arms upon the table, eyed him with an indescribable mixture of indignation and contempt. At length the orator paused. Emerson made no other reply than "Umph! more *hair* than *brains*, I perceive!"

In transcribing the preceding, we have not only retained the orthography, but also the punctuation and *italics* of the original. It would appear to have been copied from the *York Chronicle* by a pupil at Scorton, as the hand-writing partakes of the schoolboy character, and is quite different from that of Mr. Bowe's letter, which we have taken the liberty to place *first* in order, instead of *last*, as it occurs in the original document.

I am, Sir, yours, &c.,
THOMAS WILKINSON.

Burnley, Lancashire,
Feb. 15, 1850.

## THE BRITISH MUSEUM LIBRARY AND ITS CATALOGUE.

Although but comparatively few, either can or have occasion to avail themselves of our national library of the British Museum, the public, as a body, are indirectly interested in it, and as they help to support that establishment, they have a right to be satisfied that it is efficiently managed in all its departments. We need not, therefore, apologize for touching upon the subject, more especially as attention has again just been called to the Catalogue of the Museum Library by two correspondents in the *Athenæum*. With more of officiousness than judgment, a Mr. W., one of the officials of the Museum, has thought proper to vindicate the catalogue from certain remarks made upon it by Mr. Fergusson, in his pamphlet on the National Gallery and British Museum, which was published about a twelvemonth ago, and, consequently, if to be noticed or replied to at all, might have been so much earlier, were it not that tardiness and procrastination seem to be characteristic of every body and every thing belonging to or connected with the Museum. Mr. W., however, has, after all, been too precipitate; for he might as well have attempted to wash a blackamoor white, as to whitewash the catalogue by convincing us that, instead of being as mystified as it very well can be, it is an admirable specimen of lucid arrangement. How many curses have been muttered over it we dare not compute, but suspect that it would take seventy more huge folios to register them all.

Mr. Fergusson's able reply to him must have convinced Mr. W. that he has shown himself deficient in that quality which Falstaff estimates as the better part of valour. The best that can be said of the catalogue is, that it is an exceedingly good job,—so very good a one to those employed on it, that it ought to be made to last as long as possible; and at the rate at which it is going on, the new catalogue now in hand is likely to outlast several generations of readers and of catalogue-makers, the volumes of it already produced, numerous as they are, comprising only the letter A. Not satisfied with the maxim of *festina lenté*, the Museum people improve upon it by converting it into *festina lentissimé*. They should take that for their motto, and a sloth for their crest,—both which might very pertinently be made to figure within the pediment of their building; which last seems to have caught the contagion of extreme sluggishness, wherefore it is some comfort that no one is at all impatient to behold it finished. It is owing also, perhaps, to that same *festina lentissimé* which marks all the operations at the Museum, both within doors and without, that persons are so patient of the great inconveniences and annoyances occasioned by the confusedness of the present catalogue, and the want of a classed one in addition to it, they knowing very well that were the latter to be undertaken and begun to-morrow, they would never have the benefit of it.

After all, the want of a classed catalogue, and of a better alphabetical one, is only a single grievance out of many. Others there are, which are all the less tolerable because they might be removed at once, were there that disposition to accommodate the public, which in such a national establishment there ought to be. It is, for instance, no small inconvenience that there is only one set of each of the catalogues in the reading-rooms, so that a person has often to wait a considerable time before he can begin to search for what he wants; to say nothing of the crowding and jostling in that corner of the room where the catalogue desk is placed. Some trouble, again, would be obviated were the attendant who has the keys to unlock all the book-cases in the reading-rooms every morning, instead of waiting till asked to open one when perhaps he is otherwise engaged. It becomes unpleasant if a person has to apply to him repeatedly for the same purpose.

Tardiness, as we have said, pervades the whole establishment and every operation in it. The length of time, one has frequently to wait before the book he has written for is brought, is such that it might be supposed the people could not find out the shelf and number marked upon the ticket. Then the binders seem to be a most sluggish race, for you may sometimes ask repeatedly for months together for a book, and are told that it is "at binding;" which seems to be very much like its being "in bondage." Perhaps, too, when you do at length get it, on subsequent application, you find that the binders have not had it at all, it not having been put into fresh livery. There would surely be no difficulty whatever in managing the binding department greatly better; nothing more being required than to give out to the binders no more books at one time than they could return to the library within a week.

More serious inconvenience still, is caused by the provoking delay which is allowed to take place between books being actually received and their being inserted in the catalogue, until which last be done, no use can be made of them —at least, not by the public, though it possibly may by the librarians and assistants. That the latter do study their own accommodation in a somewhat unseemly manner, we ourselves happen to know, for on a friend of ours once asking for a book, instead of its being brought to him, he received for answer that "Mr. W. (viz., the writer of the letter to the *Athenæum*) was making use of it!" which is surely very much like, on your asking for the newspaper, being told that your servant Tom is reading it, and has not yet done with it. No wonder the catalogue goes on so slowly, if, instead of attending to the duties for which they are engaged, the librarians employ their time in studying or reading. Owing to the system of dilatoriness so rigidly observed at the Museum, the literary journals, foreign ones more especially, are always greatly in arrear; some of the latter so much so, that they are not to be seen until they have been published two or three years, or sometimes longer, when they are comparatively of little interest or service.

The only instance in which alacrity is shown, is in turning people out of the reading-rooms; which is done in a more peremptory than decent manner, a noisy alarum being set ringing for a quarter of an hour previous to the stentorian cry of "All out!" being uttered. What is, however, infinitely worse, is, that readers are not allowed to have the full advantage of the natural daylight. Now, if picture exhibitions are kept open till dusk, surely the Museum reading-rooms might be so also, more especially as it begins to be dusk there pretty early. People would depart without other warning than what they had from their own eyes. What is there to hinder the reading-rooms from being kept open till sunset all the year round, when they are so now, during a part of November and December? It is little less than preposterous to make such a change all at once in the hour of closing, as that from seven to four o'clock, and *vice versâ*. There might at least be a sort of "sliding scale" as to time, altering the latter only a single hour at once instead of three: *i.e.*, from seven to six, from six to five, and from five to four; and back again in the same manner. Still, to be guided by sunset would be more rational and equitable; and the Museum, no doubt, contains an almanack, which would every day settle the precise moment for the "All out!"

A *clearing out* of some of the trash or rubbish in the Library would not be at all amiss, for there are at present thousands of books which serve only to encumber the shelves and the catalogue, even such trumpery as common school books and others which do not belong to literature at all. In scandalous contrast to the superabundance of that kind, is the deficiency in regard to numerous works of real value and serviceableness, and which ought to have a place in a national collection. Nor do we allude to rare or very expensive works, but to such as are procurable enough, and therefore ought to be procured. We have frequently gone to the Museum with a list of a score of different works, out of which we have been able to find only one or two, sometimes not even a single one. To give one instance, incredible as it may appear, the Museum does not possess a copy of Hope's "Household Furniture," although it hoards up children's spelling-books, and similar literary varieties and treasures.

O. Φ

## CORNES' REGISTERED DRESSING MACHINE.

(John Cornes, of Carrow Works, Norwich, Agricultural Implement-maker, Proprietor.)

The preceding engraving is an elevation of this machine. A A is the case; B the fan; C gearing, by which the fan and other moveable parts are set in motion; D is the hopper, the feed from which is supplied to the upper riddle E; directly in front of the fan F is a second riddle, which is placed under the riddle E; G is the bottom screw. At the end nearest to the fan, the riddles are carried by the side rods H H, to which they are jointed. At the further end they are supported by rods I I, which are connected to oscillating levers K (only one of which is seen in the figure), having their centres, L, attached to the frame A. M is an eccentric wheel, which is driven by the gearing C, and is connected by a rod N to the lever K, to which, as also to the two riddles and screen, it communicates an oscillating motion. The connecting-rod N may be attached nearer to or further from the centre of the lever L by the holes O O, and so lengthen or shorten the travel given to the riddles and screen. P is the discharging spout for the lower riddle F.

## DESIGN FOR AN IMPROVED WATER-METER.

Sir,—The following design for a water-meter is one of three, which I sent to the "Society of Arts," January last, in competition for a gold medal. I was not fortunate enough to be successful, but as I think there is some merit in it, I take the present opportunity (with your kind permission), of bringing it under the notice of your numerous readers. A*a*, and A*b*, are two vessels of sheet zinc, each containing a gallon of fluid within the stroke of the air-boxes, B B, and completely covered except at the opening shown at the centre. D C, a "tumbling-bob" or "Y"; (so well known in connection with the old atmospheric steam-engine, that it does not require any particular explanation). E E, two rods, which, by means of two pins, and two projections, F F, work the index, and also the "Y," which acts on the "four-way cock." A*a* is full, and in the act of delivering water to the consumer through the eduction pipe. A*b* is

Fig. 1.

Fig. 2.

Fig. 4.

Fig. 3.

filling; which it can do more rapidly than the other can empty, on account of the great pressure from the supply pipe. The upper surface of B is made elastic by any suitable material, so that when the box reaches the top, its buoyancy and the pressure from below will make it perfectly water-tight; in which state it must remain, till B, in A*a*, having descended, and being sufficiently weighty to raise the "tumbling-bob" just beyond the perpendicular at the precise time, when A*a* is empty, the cock is reversed, and A*b* is open to the exit pipe. A*a* instantly re-fills, and *must* wait till A*b* is empty, when the cock will be again reversed: and so on. It will be seen, that as soon as the consumer's cock is shut, (supposed to be beyond the part broken off at "exit:" the cock shown cannot be touched by him,) the machine is at rest, and no more water is registered than has been taken; but immediately the cock is again opened, the process goes on where it left off.

On the same shaft at A, fig. 2, are two four-teethed wheels, one outside the case of the registering apparatus, to be worked by the projections, F F, fig. 1; and the other inside, to work into the circumference of the wheel B, which has 100 teeth: consequently, when B has made one entire revolution, 100 gallons will have passed through the meter, and that number will have been registered by the "cam,' (which serves also for a pointer,) having moved the wheel C, one tooth. As *this* wheel contains ten teeth, ten revolutions of B will cause C to go round once, and the pointer moving with it will bring 1,000 into view. When C has made ten more revolutions, 2,000 will be shown, and the last number will have disappeared. Round the circular openings at B and C, appropriate numbers may be painted, and the quantity registered may be known to a gallon. Thus—as the indices are now placed, 1,715 gallons have passed through the meter.

By adopting another disc, or wheel, instead of the slide, as at D, fig. 3, the registry might go on to nineteen or twenty thousand, if it were understood that 1 on *that* wheel, were designed to represent one thousand, and 2, two thousand, &c. At the back of each disc, a piece of bent brass should be placed to act as a spring, and keep it in the same position, till the return of the "cam" to alter it. I remain, Sir, yours truly,

WILLIAM PEARSON.

Manor School, York, July 26, 1849.

THE SCIENTIFIC ALMANACKS.

(Concluded from page 131.)

*The Lady's and Gentleman's Diary.*

Mr. Kirkman is quite correct in asserting that there is no reading and purchasing public for books of pure science in England. Such works flourish in France, Germany, &c., but in England, be their merits ever so great, they soon wither and die, in consequence of sheer neglect; they are generally attended with a dead loss to their projectors, and are often held in a rickety existence—a sort of forlorn hope—by dint of individual exertion and private loss. How is this? Taking our position as a nation, with respect to arts and sciences, what it really is, in reference to that of the nations mentioned—how it is that they foster and support periodicals on pure science—whereas we support nothing of the kind! How may this anomaly, which affects the national character in some degree, be explained? It would require a long discussion, perhaps, to give a full elucidation, but we think a sufficient explanation is on the surface of our general policy. Pure science in other countries, where its journals and periodicals thrive, often leads to wealth and honours. France has long rewarded the successful cultivators of pure science with most flattering distinctions. To be celebrated in these sciences was almost a certain attainment of a high position amongst the most eminent and influential men of that country. The state encourages the cultivation of the pure sciences, by the rewards which it bestows on its successful votaries, and by the positions in which it places men most renowned for their accomplishments. Is it so with us? Do our rulers, of whatever colour or clique, thus encourage the cultivators of pure science? We think not. The proud eminence we hold as a nation is principally owing to the successful application of pure science to a variety of subjects; nevertheless, instead of encouraging the cultivators

of abstract science, the State takes the results of their labours—the workings of their brains—turns them to its purposes, and then treats their genius with chilling neglect. Does it not take the formulæ which the votarists of pure science have spent days and nights to produce—apply them to its navigation and machinery—but give their authors neither reward nor thanks? As far as the Governmental policy of this country is concerned, is not the cultivation of pure science rather depressed than encouraged? Does it ever lead to any kind of promotion? Did it ever bring its possessor, unless he had some political influence, any post above an exciseman's office? Does it ever effect more, now? Is not, then, the cultivation of pure science, except for the mental pleasure which it affords, a hopeless pursuit? Do not splendid acquirements in pure science rather impede the possessor's progress in life than assist it? Is it not considered by British political rulers an impediment rather than a high accomplishment? The fact is, that nineteen out of every twenty of the men who wriggle themselves into political power in England, know nothing whatever about pure science; they have no faculties to appreciate its value—they regard its cultivators as the possessors of a kind of black art, and they are accordingly kept at a distance. Certainly, as far as the State's influence extends, pure science is not only neglected, but it is discouraged. Again and again has it happened, that men start in business, at length cheat those who were sufficiently stupid to trust them—then make politics a trade—by-and-bye, join in the fashionable clamour for some change—next they hold on by the skirts of some political claptrap, and thus at length worm their way up to high office and legislative distinction. The cultivator of pure science, no matter how splendid his talents, varied his accomplishments, or unsullied his honour, stands no chance with that sort of adventurer in England. Our rulers appear to have a sympathy for clever deluders in preference to unsophisticated men of science; the State seems to delight in honouring men who possess a talent that has enabled them to leave their creditors in the lurch, and then to set up as law-makers for their country's welfare. These, and like considerations, will, we think, explain how it is that works on pure science obtain no support: the practitioners of humbug and knavery are countenanced and honoured—pure science is discouraged and treated with indifference. Hence the reason, why one thrives and the other does not, is obvious. This view of the subject is supported by the pay which the State gives its servants for their labours in pure science. We have already made some remarks on the stipends paid to the calculators in the Nautical Almanack-office. According to public report, many of the veterans at the Royal Observatory, Greenwich—men of high attainment, and who have been for years there at hard brain work in making intricate calculations of deep importance to the country, are paid only 120*l.* or 130*l.* a year!! What encouragement does this famine, pay—or next to it—hold out to the cultivators of pure science? Such pay, for such labour, is a public scandal to the nation that gives it—and an utter disgrace to men at the head of such establishments, who permit their subordinates to be so treated. This country evidently does not improve in its public treatment of men who cultivate pure science. This assertion, we think, can easily be proved. We read in the Memoirs of the late Dr. Hutton, that on a vacancy occurring in the Professorship of Mathematics at Woolwich, he was induced to come down from Newcastle as a candidate for the post. He was only known as a *Diarian* of considerable attainments. There were many competitors, but Hutton, after a long and severe contest, beat them all, and was appointed to the office. This was as it should be; but this occurred 77 years ago. In more recent times, if report be true, a somewhat similar post was vacant. Candidates were invited to compete for it, one candidate, quite as distinguished as Hutton, was induced to come down from the same part of the country; he, too, vanquished all his competitors, and

was declared the best qualified as a MATHEMATICIAN for a MATHEMATICAL POST—but the post was bestowed on a BEATEN CANDIDATE!!

The PUBLIC has very recently treated a celebrated cultivator of pure science not only harshly, but with savage cruelty.

In the January number of the *Philosophical Magazine*, there is an interesting article on the Property of Interminable Decimals, by Professor Young, of Belfast. At the close of the article, the author says, "The readers of this journal will perhaps pardon me for obtruding upon their attention matters of so truly elementary a character. The composition of the paper has, for a few hours, relieved my mind from the pressure of a most painful and a most unmerited calamity; and as it is very probable that I shall not encumber these pages again for a long time, I crave their indulgence on the ground just stated."

The Editor adds, "With sincere regret we advert to the circumstance to which our able and valued correspondent refers. The Royal Belfast Academy, in which Mr. Young has with the highest reputation filled the Chair of Mathematics for sixteen years, having emerged in the New College of Ulster, he has been superseded, and is now sent adrift upon the world, his library sold, or rather thrown away, and his large family reduced to destitution. Surely the long and able services of such a man, in an Institution supported by a Parliamentary grant, must entitle him at least to compensation by a superannuation allowance. To the value of those services, and to his great ability as a writer, ample testimony has been given by the most eminent mathematicians, Dr. Peacock, Professors Challis, King, Sir D. Brewster, Sir W. R. Hamilton, Graves, Baden Powell, Sir J. W. Lubbock, Kelland, Christie, and De Morgan; whilst the whole of his late colleagues in the Academy, and all the clergy of Belfast have thus expressed their sense of his moral worth. Amidst all the difficulties surrounding him as the head of a numerous, and therefore helpless family, we have reason to believe that his probity and correctness of conduct have ever remained irreproachable, nor have we, at any time, heard of the least moral taint attaching to his reputation. Under all these circumstances, we deeply sympathise with Mr. Young, and so, we are satisfied, will the public in general."

This is the manner in which the British public, at this time, treats one of its most distinguished cultivators of science, after sixteen years faithful and valuable services. The Editor's remarks, which we have cited, do credit to his heart and head. But who inflicted the "unmerited calamity" on Mr. Young? Who has perpetrated such an outrage on one of pure science's most useful and esteemed votaries? Is it to be done with impunity? Cannot reprisals be taken? At all events, let it be known who has thrown such a scandal upon the country. But there is another reason, which in some measure explains why *some* of these publications have not succeeded. Mr. Wilkinson's very instructive and highly-interesting articles on scientific periodicals, which he has published in this Magazine, have taught us that some of the projectors of such publications have been made up of almost every ingredient which forms a vicious and repulsive character—the publication could not be disassociated from its odious authors, their undertakings did not succeed: they were undeserving of success, and therefore their failure occasioned no regret.

The same remarks obviously apply to other failures. The scheme was founded more in selfishness than in any love of science. It is known that the conductors seized every opportunity to injure their best friends and supporters. Whilst they have been welcome guests at their friends' tables, and receiving their kindness and assistance, those scientific schemers were clandestinely plotting against their interest—and rejoicing in their misfortunes. "Dipping the hand in the dish," and the "Hail, Master! and kissed him," were perfidy of the same base kind. The ancient Judas had some compunction, and paid honestly for his

treachery; the modern Iscariots evince no such redeeming qualities—at any rate, we have not heard that they ever threw down the silver, and cleared the country of a nuisance by following out their prototype's example to its fullest extent. They did not do this, perhaps; but that they failed in their selfish speculations occasioned no surprise, and certainly no sorrow. No one would like to see any production from such a quarter; it would be a sort of leprosy spot, that would be a defilement to a whole library.

We quite concur in the opinion which Mr. Kirkman has so well expressed as to the difficulty which stands in the way of an English student's making himself acquainted with the Memoirs, and other works of great interest and importance—that are easy of access to students on the Continent. We moreover duly appreciate the value and utility of some of the ingenious essays which occasionally fall in our way. At the same time, we may observe, that some of these Memoirs are so replete with a kind of mystical transcendentalism, that we conceive them to be more ingenious than useful. For instance, we have met with an article in which all the letters of the Greek, Roman, Italian, and old English alphabets, are employed—besides all the great and small letters of all these alphabets; each letter is further distinguished by a variety of indices and suffices —and lastly, some of the letters stand in their proper position, others with their heads downwards, and many in a sideways direction. All these characters, at last, are marshalled into groups, which their learned formers assert represent something or other, which they may well wish any one to guess who can. How far the employment of such a number of symbols tends to elucidate a subject or to advance science, we offer no opinion. Paley gives the great number of drawers, pots, bottles, &c., in a chemist's shop, and the chemist's knowledge of their whereabouts, as a proof that a great number of things may be kept in the mind by habit and arrangement. No doubt the authors of the Memoirs, by a similar habit, very severely stretched, know what each symbol represents at the end of the process. If they do, they prove that their memories are of the first order—but the "*cui bono*" is quite another question.

We should like to see such a report as Mr. Kirkman suggests: we have already given an opinion as to the influence of the Diary.

*The British Almanack and Companion.*

The *British Almanack* has acquired a high character for supplying a large fund of very useful information at a small cost. The Astronomical Phenomena, Tables, &c., are fully adequate to meet the general reader's wants. It would add to the Almanack's usefulness as a book of reference, if, with the list of Members of Parliament their residences were given. Upon the whole, we think the merits of this Almanack fairly entitle it to that large share of public patronage which is bestowed upon it.

The Companion to this Almanack, for some years after its first publication, annually contained scientific articles by Sir J. Lubbock and others of a high order and great interest; we have now, however, closed the publication as a scientific one in remembrance of what it was, and not in consequence of what it is. Its list of contributors on science, has grown "small by degrees and beautifully less," until it has dwindled down to one—"a last rose of summer left withering alone." The one contributor has contributed one paper "On Ancient and Modern Usage in Reckoning."

The learned critic's *chef d'œuvre*, is considered, by competent judges, to be an Essay on *Old Almanacks* printed a few years ago in this annual, and supposed to be written with the view of surpassing a profound memoir on the same subject by James O. Halliwell, Esq., F.R. and A.S.S., but the tremendous effort which the learned writer then made to excel many titled competitors for honours in the antique line appears to have had a sad effect upon his mental powers—at any rate, his efforts have since yearly become duller and duller;

happily, at last, we should suppose, "the ancient and modern usage in reckoning" indicates the lowest point to which the *vis inertia* of the learned writer's peculiar ge-genius can force him.

We will give a few extracts from the article.

The learned author says, "Those who are accustomed to settle the meaning of ancient phrases by self-examination will find some *strange* conclusions arrived at by us." The writer never wrote a more correct sentence —it admits of no kind of dispute.

"Language and counting," says the learned author, "both came before the logical discussion of either. It is not allowable to argue that something is or was, because it ought to be or ought to have been. That two negatives make an affirmative, ought to be; if *no* man have done *nothing*, the man who has done nothing does not exist, and *every* man has done *something*. But in Greek, and in uneducated English, it is unquestionable that "no man has done nothing" is only an emphatic way of saying that no man has done *anything;* and it would be absurd to reason that it could not have been so, because it should not."—p. 5.

"But there *is* another difference between old and new times, yet more remarkable, for we have *nothing* of it now: whereas in things indivisible we count with our fathers, and should say in buying an acre of land, that the result has no parts, and that the purchaser, till he owns all the ground, owns none, the change of possession being instantaneous. This second difference lies in the habit of considering nothing, nought, zero, cipher, or whatever it may be called to be at the beginning of the scale of numbers. Count four days from Monday: we should now say Tuesday, Wednesday, Thursday, Friday; formerly, it would have been Monday, Tuesday, Wednesday, Thursday. Had we asked, what at that rate is the first day from Monday, all would have stared at a phrase they had never heard. Those who were capable of extending language would have said, Why it must be Monday itself: the rest would have said, there can be no first day from Monday, for the day after is Tuesday, which must be the second day: Monday, one; Tuesday, two."—p, 10.

We assure our readers that the whole article is equally lucid, and its logic alike formal.

There are some exceedingly valuable foot-notes; we give one of the most interesting, taken from the learned Mr. Halliwell's profound book on Nursery Rhymes—a celebrated production, for which it is supposed the author was made F.R.S.

"*One's nine*,
Two's some,
Three's a many,
Four's a penny,
Five's a little hundred."

"The last line refers to five score, the so-called hundred being more usually six score. The first line, looked at etymologically, is *one is not one*, and the change of thought by which *nine*, the decimal of *one*, aims to be associated with the decimal of *plurality* is curious:"—Very,

This valuable and profound essay will very probably be transferred to the next edition of the learned Mr. Halliwell's rare work, of kindred worth, entitled "RARA MATHEMATICA," it will then be deservedly handed down to posterity as a covering for cheap trunks—a most appropriate archive for such a treasure.

When the Companion to the British Almanack was first published, the original articles on various points of pure and mixed science rendered it well worth its cost, 3s. Although the Companion still supplies the reader with a large quantity of information, it is totally different; instead of original essays, a very large portion of the book is filled with that kind of matter which may properly be denominated "Official Paste and Scissors' Work." Readers, who have access to Parliamentary returns, the Statistical Journal, &c., do not want to purchase the same information twice. The Article on Railways, which fills so large a part of every number, should be termed, "Acts, and the effects of Acts, passed in reign of King Hudson of Pious Memory."

In our opinion the COMPANION has very sadly deteriorated; we have already remarked upon its solitary original article, and we think the price is too high for mere scissors' labour, and official paste composition.

*The Illustrated Almanack.*

This is one of the most beautiful and most useful annuals that is published in this country, or, at the same trifling cost, in any other.

Whether to amuse or instruct; whether to lie on the drawing-room table as an ornament, or on the student's desk as an article of reference, we can most heartily recommend it.

We learn from the Introduction, "that all those Divisions of the Almanack for 1846, relating to the Calendar, to Astronomy, and to science in general, were intrusted to James Glaisher, Esq., F.R.S., F.R.A.S., of the Royal Observatory Greenwich; and all relating to those subjects since that time have been under his superintendence." Hence the accuracy of the information on the several heads may be depended on. The article on the Meteorology of England, in the present number, is particularly valuable; it is worth more than the cost of the book.

The Astronomical Phenomena which are most remarkable in each month are uniquely exhibited in light and shade, so as to convey a more accurate notion of their reality than the reader is likely to meet with elsewhere. The direction of moonlight, in each month, is shown in a manner which must convey a most useful lesson to the student.

The "Notes on the Month" are by Mrs. Loudon. These consist of a description of the bird, plant, and insect, which have some characteristic connected with the month: the entertaining and instructive writing of the accomplished authoress is beautifully illustrated by wood-cuts of the things described. Each month is also elucidated by a mythological representation of the month, and also by a print appropriate to the season: these show to what a high degree of perfection pictorial art of this kind has been carried in England.

We trust the spirited publishers are repaid for preparing with such taste and care this elegant annual. It would be a sad reflection on the public intellectual discernment, if it did not amply support such a peerless gem rendered at so cheap a rate.

THE USE OF THE VACUUM VESSEL AS AN APPENDAGE TO PUMPS.

Sir,—As it strikes me that both Mr. Baddeley's and a "London Engineer's" replies to Mr. Hulse respecting air vessels to pumps, more particularly as applied to the suction pipe, are founded in error, I would beg to inform those gentlemen that a *vacuum* vessel has enabled me for the last three years to work, without any jar, a 5-inch single barrel force pump, of 12 inches stroke, at forty strokes per minute and upwards. The lift is about 22 feet with 3 inch suction pipe: the delivery 40 ft., also with 3 inch pipe. Before the application of the vacuum vessel, which is simply a perpendicular elongation of the suction pipe, some 15 feet higher than the pump itself, and of course closed at the top, the pipe, which is of strong copper, burst on several occasions, and the jar would soon have destroyed the pump. Mr. Baddeley is perfectly correct in saying, that "the first action of a pump is to exhaust the air from the suction pipe;" and of this I take advantage by continuing my suction pipe some feet higher than water will rise in vacuo, viz., 32 or 33 feet; there is then an empty space to receive the flow of water, which, when suddenly arrested at a high velocity at the end of each stroke, would, without such provision, impinge on the terminus of the pipe and produce the concussions complained of. My pump was furnished with an air vessel as usual, when put down. The vacuum vessel was my own. I shall be happy to furnish Mr. Hulse with a diagram, if I have not been sufficiently explicit.

Yours respectfully,

J. B. S.

Oakham, January 3, 1850.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 21, 1850.

FREDERICK WILLIAM BODMER, Paris, France, C. E. *For certain improvements in machinery or apparatus for letter-press printing.* Patent dated August 16, 1849.

The patentee proposes to print two endless webs of paper simultaneously, by means of two duplicate type cylinders, which print (say) the obverse sides of the two webs, while a third type cylinder prints the reverse of both webs at the same time.

The paper is damped before entering the machine, by means of rotary brushes dipping partially into water, and is dried after each impression by the action of a rotary fan. As the printed webs of paper are delivered from the machine, they are divided transversely into sheets by means of suitable cutting machines.

No claims are made in this specification.

JAMES YOUNG, of Manchester, manufacturing chemist. *For improvements in the treatment of certain ores and other matters containing metals, and in obtaining products therefrom.* Patent dated August 16, 1849.

*Claims.*—1. A peculiar method of producing stannate of soda and stannate of potash.

2. Another method of producing the same.

3. A third method.

4. A method of producing the stannates of lime, barytes, and strontian.

5, 6, and 7. A mode of obtaining lead,
From native carbonate of lead,
From galena,
From lead slag. And

8. A mode of obtaining a compound of lead and antimony from slags.

RICHARD ARCHIBALD BROOMAN, of the Patent-office, 166, Fleet-street. *For improvements in machinery, apparatus, and processes for extracting, depurating, forming, drying, and evaporating substances.* (A communication.) Patent dated August 16, 1849.

See *ante*, p. 141.

JONATHAN BLAKE, of Mount Pleasant, Eaton, Norwich, surgeon. *For certain improvements in lamps.* Patent dated August 16, 1849.

Mr. Blake describes—

1. Some improvements applicable to spirit lamps, more particularly those in which camphine and naphtha are burnt, and which have for their object to obviate more effectually, than has been hitherto done, the smoke and sooty exhalations called "blacks," with which the burning of such lamps is commonly accompanied, as also to render them perfectly safe from explosion. And

2. Some improvements in candle-lamps, by which the supply of air will be better regulated, and guttering prevented. We shall give the details of both improvements, with engravings, in an early Number.

LOUIS LEMAITRE, late of Paris, but now of the Hôtel de L'Universe, Blackfriars, engineer. *For improvements in the manufacture of ferrules for fixing the tubes of locomotive and other boilers.* Patent dated August 16, 1849.

The object of this invention is to manufacture ferrules by machinery instead of by hand. For this purpose a strip of iron or steel of the desired width is passed between a pair of grooved rollers, to form one edge thinner than the other; after which the strips are cut into lengths to form the ferrules, and bent into a circle by being caused to pass on a mandril underneath a roller. The mandril is supported in one end of a rotary shaft, the other being fitted with a winch-handle. The shaft has a groove cut in it longitudinally to receive a bent lever, carrying at its free end, just over the mandril, a piece of metal, which is caused to hold the strip of metal between it and the mandril, on motion being communicated to a second lever connected to the first. Above the mandril is a roller suspended in one end of a lever, which is depressed by hand, and made to bear against the strip of metal, so as to bend it into the required shape. This roughly-formed ferrule is (either when cold or raised to a welding heat, or heated to make it pliable,) submitted to the action of a punch and die, whereby it will be finished, so that the exterior surface will not require turning in a lathe, and the edges welded or pressed together accordingly. When the edges are not to be welded, they are made curved or angular, in order that, when subjected to an uneven force at the edges, they may support one another, and prevent the ferrule from being forced out of shape.

The punch slides in a guide, and is worked by being attached to one end of a horizontal lever, the other end of which is connected to the piston-rod of a steam engine. The die is in two portions, and is supported in a plate, which is made to slide up and down by being supported on pillars rising from an open frame, in which is a cam shaft worked by a hand-lever, and the die closed or opened accordingly, to allow of the ferrule being punched in and afterwards taken out.

*Claims.*—1. The mode of using a punch for forcing into a suitably-formed die a strip of metal which has been previously bent into

the required shape, but not welded when the punch or die, or both of them, is made to work in guides.

2. The mode of operating as before, for welding, or giving the required form to strips of metal.

3. The manufacture of ferrules of strips of metal, not previously welded, when the junction of the sides are in a curved or angular line.

4. The manufacture of ferrules of strips of metal with one edge made thinner than the other, by the process of rolling, in order to give the desired form to the ferrules to facilitate their entrance into tubes.

ARTHUR DUNN, Worcester, soap maker. *For improvements in soap making.* Patent dated August 17, 1849.

Mr. Dunn remarks, that it has hitherto been customary for the manufacturers of the better kinds of soap to mark the cakes with certain letters or designs, but which are completely effaced after a little use, and that the object of his invention is to make such letters or designs last longer than has yet been practicable by making them considerably deeper than heretofore, and filling in the sunken parts with differently coloured soap, in a plastic state, with a spatula; care being taken to remove any unevenness of surface or excess of coloured soap by scraping. Instead of coloured soap powdered soap may be used, and filled into the sunken parts; the external surface being covered with plastic soap of the same colour as the powdered soap to prevent its falling out. As the soap wears away, the water will moisten the powdered soap and cause it to adhere together.

*Claim.*—The mode of marking soap with letters and designs with soap or other suitable material which varies in colour from the soap to be marked.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Whiffen of Pig's Quay, Bridewell-precinct, accountant, for improvements in machinery for registering the delivery of goods. February 21; six months.

John Stephen Woolrich, of Wednesbury, Stafford, chemist; John James Russell, of Handsworth, in the same county, and Thomas Henry Russell, of Wednesbury aforesaid, patent tube manufacturers, for improvements in obtaining cadmium and other metals and products from ores or matters containing them. February 21; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in separating and assorting solid materials or substances of different specific gravities. (A communication.) February 21; six months.

John Slack, of Manchester, Lancaster, manager, for certain improvements in the manufacture of textile goods or fabrics, and in certain machinery or apparatus connected therewith. February 21; six months.

Alexander Hedlard, of Paris, France, gentleman, for certain improvements in propelling. February 21; six months.

George Holworthy Palmer, of Westbourne Villas, Harrow-road, Middlesex, civil engineer, and Joshua Horton, of Ætna Steam-engine Boiler and Gasometer Manufactory, Smethwick, near Birmingham, Stafford, for improvements in the arrangement and construction of gas-holders. February 21; six months.

William Cormack, of King-street, Dunston-road, Haggerstone, Middlesex, chemist, for improvements in purifying gas; also applicable in obtaining or separating certain products or materials from gas, water, and other similar fluids. February 21; six months.

William Mayo, of the firm of Mayo and Warmington, Silver-street, Wood-street, Cheapside, manufacturer, for improvements in connecting tubes and pipes, and other surfaces of glass and earthenware and in connecting other matters with glass and earthenware. February 21; six months.

John Scoffern, of Essex-street, Middlesex, M.B., for improvements in the manufacture and refining of sugar, and in the treatment and use of matters obtained in such manufacture, and in the construction of valves used in such and other manufactures. February 21; six months.

## LIST OF SCOTCH PATENTS FROM 23RD OF JANUARY, 1850, TO THE 15TH OF FEBRUARY, 1850, INCLUSIVE.

Joseph Clinton Robertson, of 166, Fleet-street, London, civil engineer, for improvements in machinery, apparatus, and processes for extracting, depurating, forming, drying, and evaporating sub-substances. (Communication.) Sealed January 23; six months.

William Thomas Henley, of Clerkenwell, Middlesex, philosophical instrument maker, for certain improvements in telegraphic communication, and in apparatus connected therewith; part of which improvements may be also applied to the moving of other machines and machinery. January 23; six months.

Christopher Nickels, of York-road, Lambeth, Surrey, gentleman, for improvements in the manufacture of woollen and other fabrics. January 24; six months.

Ewald Riepe, of Finsbury-square, Middlesex, merchant, for improvements in the manufacture of steel. January 24; six months.

Benjamin Thompson, Newcastle-upon-Tyne, civil engineer, for improvements in the manufacture of iron. January 31; six months.

Elijah Galloway, of Southampton-buildings, Chancery-lane, Middlesex, civil engineer, for improvements in furnaces. February 1; six months.

Thomas Marsden, of Salford, Lancashire, machine maker, for improvements in machinery for heckling, combing, or dressing flax, wool, and other fibrous substances. February 1; six months.

Robert Fayrer, of Surrey-street, Strand, commander, R.N., for improvements in steering apparatus. February 1; six months.

Macgregor Laird, of Birkenhead, gent., for improvements in the construction of metallic ships or vessels, and in materials for coating the bottom of iron ships or vessels, and in steering ships or vessels. February 6; six months.

James Templeton, of Glasgow, manufacturer, for certain improvements in manufacturing figured fabrics, principally designed for the production of carpeting. February 12; six months.

William Henry Green, of Basinghall-street, London, gent., for improvements in the preparation of peat fuel, and in the mode of applying the products derived therefrom to the preservation of certain substances which are subject to decay. (Communication.) February 12; six months.

Joseph Long and James Long, of Little Tower-street, London, philosophical instrument makers, and Richard Pattendon, of Nelson-square, Surrey, engineer, for improvements in instruments and machinery for steering ships, which is also applicable to vices, and other instruments and machinery for obtaining power. February 12; six months.

William Mayo, of the firm of Mayo and Warmington, Silver-street, Wood-street, Cheapside, London, manufacturers of mineral aërated waters, for improvements in connecting tubes and pipes and other surfaces of glass and earthenware, and in connecting other matters with glass and earthenware. February 13; six months.

James M'Donald, of Chester, coach maker, for certain improvements in the method of applying oil or grease to wheels and axles, and to machinery, and in connecting the springs of wheel-carriages with the axles or axle-boxes. February 13; six months.

Henry Attwood, of Goodman's-fields, Middlesex, engineer, and John Renton of Bromley, in the same county, engineer, for certain improvements in the manufacture of starch and the like articles of commerce from farinacious and leguminous substances. February 14; six months.

William Furness, of Liverpool, builder, for improvements in machinery for cutting, tenoning, planing, moulding, dove-tailing, boring, mortising, tongueing, grooving, and sawing wood; also for sharpening and grinding tools or surfaces, and also in welding steel to cast iron. (Communication.) February 15; six months.

Sir John Macneill, Knight of Dublin, and Thomas Barry, of Lyons, near Dublin, mechanic, for improvements in locomotive engines, and in the construction of railways. February 15; six months.

## LIST OF IRISH PATENTS SEALED FROM 28TH OF JANUARY, TO THE 12TH OF FEBRUARY, 1850.

Alexander Swan, of Kircaldy, Fife, manufacturer, fo rimprovements in heating apparatus and in applying hot and warm air to manufacturing and other purposes when the same are required. January 28.

Jacques Hulot, of Rue St. Joseph, Paris, France, manufacturer, for improvements in the manufacture of fronts of shirts. January 1.

Thomas John Knowlys, of Heysham Tower, near Lancaster, esq., for improvements in the application and combination of mineral and vegetable products from mineral and vegetable substances, and in the generation and application of heat. February 4.

Thomas Henry Russell, patent tube manufacturer, of Wednesbury, and John Stephen Woolrich, of Birmingham, chemist, for improvements in coating iron and certain other metals, and alloys of metals. February 12.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Feb. 15 | 2187 | Samuel Hiron | Birmingham | Press for embossing and other purposes. |
| 16 | 2188 | Thomes Wells Cross | Leeds | Barrel with grooved and tongued staves. |
| 18 | 2189 | Anthony Mayer | Sagave-gardens, Tower-hill | Sawing instrument. |
| 20 | 2190 | John Sanders | Wood-street, Cheapside | An umbrella tent. |

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1386.] SATURDAY, MARCH 2, 1850. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.


## BLAKE'S PATENT SPIRIT AND CANDLE LAMPS.

Fig. 3.

Fig. 1.

Fig. 2.

Fig. 4.

## BLAKE'S PATENT SPIRIT AND CANDLE LAMPS.

We now present our readers with the details of the improvements embodied in these lamps (see *ante* p., 158). Fig. 1 is a sectional elevation, and fig. 2 a plan of the spirit lamp; and fig. 3 and fig. 4 are similar views of the candle lamp.

### *The Spirit Lamp.*

The lamp is represented as having four burners, but the number may be increased or diminished at pleasure, according to circumstances. In general, I find that it is preferable to use a number of small burners to produce any required amount of light than it is to produce the same amount of light by a single burner of larger size, and that the best size for a single burner is about half an inch; that is to say, that it should be no larger than to allow of the ring of wick being about from three-eighths to half an inch in diameter. The reservoir AA for containing the spirit to be burned is divided into as many compartments as there are burners, in order to prevent the wicks of the different burners from becoming entangled, or the fluid from being shaken about in moving the lamp from place to place. The partitions between these compartments have holes in them to allow of the flow of the fluid from the one to the other, so that it may stand at the same level in all. The spirit is introduced into the reservoir through a screw-plug B, and there is a small float *c*, by which the state of the supply can be ascertained at any time by mere inspection. The basement of the burner communicates by a tubular neck C with the reservoir A, the junction of the two being effected by means of a ring D, and three small screws, *sss*, which are screwed through the ring, and press firmly against the sides of the tubular neck. The annular space within the ring is afterwards covered over with a loose flat disc $D^1$, which prevents any escape of the fluid at that part; and as the only metallic connections between the burner and reservoir are the points of the three small screws, the risk of the heat being communicated from the one to the other is extremely small. The tubular neck C is covered in at top with the exception of a lunette-shaped opening, through which the wick passes up into the burner E. Externally the burner is of a conical shape, with an opening F on one side, through which the air is admitted into the internal air-tube G. The wick most suitable for a lamp of this construction consists of a flat band of cotton of a breadth about three times the diameter of the burner, so that it may form a complete circle at top. H is a piece of metal with a slot in it, which is just of sufficient size to allow the wick to be drawn through it, and when it is so fitted on the wick it is screwed down upon its place on the reservoir.

The pressure which the wick sustains by the edges of the slotted piece of metal H, regulates in a great degree the ascent of the spirit into the burner, while at the same time it prevents not only any overflow of the spirit in the event of the lamp being upset from carelessness, but any passage of flame from the burner to the reservoir, and admits of replenishing the reservoir with spirit without danger of explosion. The raising of the wick when trimming is effected by introducing a pin successively into the holes *ooo*, on the side of the burner, and the wick when once trimmed will last for eight or ten hours burning, without requiring to be retouched, and when the spirit is of ordinary purity, a wick of moderate length will last from six to twelve months without requiring renewal. The holes *ooo*, which have been described as used for raising the wick, serve also as escape valves for any vapourised spirit, whereby all risk of its accumulating in the interior of the burner, and either exploding or blowing out the light is completely obviated. I is a head-piece to the burner, which serves as a gallery for supporting the glass, and also to sustain other arrangements for regulating the quantity of air to be admitted to the flame from the outside. The air to the exterior of the flame is supplied through an aperture below the ring *d*, whence it passes up between the flame and the glass cylinder K, which rests upon the ring *d*. The glass cylinder K is made of a length corresponding with the greatest height of flame which it is desired the lamp shall produce, and it carries upon its upper end a ring of metal L, which forms a flange projecting inwards partly over the flame, by which the air is arrested in its ascent, and deflected inwards upon the flame. On the action of this deflecting ring, the height and

smokelessness, and freedom from smell of the flame in a great measure depend. The necessity for the ring may be superseded by making the top of the glass cylinder in the first instance of a conical shape or with a projecting flange of glass; but I greatly prefer the metal ring, on account of its not being liable to break, and admitting of greater nicety in the fitting. The admission of air to the interior of the flame is adjusted by means of a slide valve L′, which covers the opening M in the head I. The opening M in the head exactly corresponds to the position of the opening F in the side of the burner, so that when M is closed by this slide-valve, very little air can enter into the internal air-tube G. N is a spindle to the slide-valve, which is passed through a hole formed in a projecting pin O, in which the spindle is free to be moved when acted upon by hand. By more or less closing the aperture M, the flame can be regulated with great accuracy. Instead of the slide-valve L′ for regulating the current of air, a conical or any other suitable form of valve may be used. P is the glass chimney, which has a fine wire gauze cylinder R fitted upon its upper end, and should the flame occasionally rise too high and produce blacks, these, as generated, will adhere to the interior of the wire gauze, the meshes of which are too small to allow them to pass through. When the wire gauze becomes completely covered, and the meshes closed, the flame will from want of air become extinguished, and thus the evil produced be the means of its own cure.

*The Candle Lamp.*

AA is a case or holder which contains a helical spring B, similar to those ordinarily used in candle lamps, which is surmounted by a disc on which the bottom of the candle rests; C is a tube which fits by a bayonet-joint on the case A, and serves to hold the candle as it is pushed up by the spring B, terminating at top in a nozzle of a conical form; D is an outer tube concentric to C, and soldered to the case A. $D^2$ is a cap which is curved inwards at top towards the apex of the nozzle; *bb* are apertures in the cap $D^2$, by which air is admitted from the external atmosphere into the space between the tube C and cap $D^2$, passing up which, the air goes first to keep the nozzle cool, and thence to feed the flame, the curved lip of the cap serving to deflect the current inwards. *cc* are apertures in the curved lip of the cap, through which a portion of the air which ascends between the tube C and the cap $D^2$ finds its way (as indicated by the arrows) to the outside of the top of the column of flame, and which has the effect of keeping the wicks of the candle from bending over the cap and overheating it. The other portion of air admitted by the openings *bb*, escapes by the openings *dd*, between the top of the nozzle and lip of the cap, and goes to support the combustion of the interior of the flame, and prevent the candle from melting too fast. G is a slotted ring, by the turning round of which the apertures *bb* can at any time be more or less opened for regulating the quantity of air. K is a glass cone which is brought down considerably below the top of the nozzle, in order to concentrate the three currents of air indicated by the arrows upon the flame. These different currents of air passing, as described, keep the nozzle, the cap, and glass cone cool, and enable the outer glass chimney to be brought down considerably below the point of ignition, and thereby produces a more perfect combustion. I is a glass chimney, and H a gallery which supports the cone, K, and chimney, I.

## THE ELECTRO-CHEMICAL COPYING TELEGRAPH.

Sir,—In the last Number of your valuable Magazine (No. 1385) I find an illustrated description of an electro-chemical copying telegraph, which was patented in 1843 by Mr. Alexander Bain. The author of this description is the patentee himself, and he informs us that during his recent sojourn in the United States, a gentleman of the name of Bakewell, "taking advantage of his absence," solicited and obtained a patent for the very invention which he had previously secured, and in proof of his declared priority of invention, Mr. Bain refers your readers to the specification of his English patent deposited in the Enrolment-office, Chancery-lane. The position thus assumed by your correspondent is fair, and

apparently incontestible. I neither come forward to question its accuracy, nor to interfere in any dispute to which it may chance to give rise: but I simply desire to express my great and unqualified astonishment that Mr. Bain,—a man of philosophy, enlightenment, and supposed liberality of principle,—should insist so earnestly upon the particular share of credit which is due to himself, and should studiously fail at the same time to recognize the true, legitimate, and undeniable dues of other parties! I write this letter as an act of necessary justice, not only to myself, but to the inventive world generally; for, let it not be forgotten, that in every question of this kind, there is a great and general principle involved,—a principle in which all thinkers and toilers in the wide field of practical science are more or less interested. Mr. Bain may have given strong evidence of persevering zeal and ingenuity in his long-continued efforts to extend the useful applications of philosophy; but let him rest assured that he is only disturbing the creditable realities of his position by quietly slurring over the original and relevant ideas of others, or by attempting to establish a claim where he has not even the ghost of a title. What is the meaning of the following sentence in his letter of last week?—"The fact is, that there is not a single feature, either electrical, *chemical*, or mechanical, in Mr. Bakewell's plan, that is not embodied in my patents of 1843 and 1846." CHEMICAL! Can Mr. Bain show me *a single chemical novelty* in either of his specifications? Can he show me one single feature in his "chemically-prepared paper" for receiving telegraphic communications *which he did not derive directly from me?* I ask him in candour and honesty to answer this question. Let him not think to supersede the fact (as he attempted to do on a former occasion) by referring to Davey as the true inventor of the process. The facts and realities pertaining to the present case are plain, patent, and incontrovertible. In 1838 or 1839, Mr. Davey obtained a patent for an improved electric telegraph. In this invention, signals and intelligence were forwarded from place to place through the instrumentality of dots or marks, which were produced at the receiving-station by the electrolytic action of platina wires upon paper, moistened with a solution of iodide of potassium and starch. This was an ingenious idea, but it embodied nothing original in a *chemical* point of view. It was a mere mechanical adaptation of an old experiment which had been exhibited over and over again in the various lecture-rooms of the metropolis—an experiment, too, which, of the kind, was remarkably easy of performance; for Dr. Faraday had previously shown that a single voltaic cell furnished power sufficient for the purpose, without even the necessity for metallic contact in any part of the circuit. (*Experimental Researches, 8th Series, Phil. Trans.*, 1834.) So much, then, for the *chemical* portion of Mr. Davey's invention. But, to proceed. In 1841 I obtained a patent for a new method of printing, in one or more colours, by means of electricity; and, by applying the new principle embodied therein, an eminent London manufacturer succeeded in producing a few very beautiful effects upon prepared paper. I say a few, for it so happened that an unexpected difficulty arose, which marred the further progress of experiment. It was found, from some cause or other, that after two or three impressions had been taken from any metallic surface, all further action was suspended, and the arrangement might then be left in contact with the battery for a whole hour without the production of any effect. I beg to call the particular attention of your readers to this circumstance, as, in its bearing upon rapid telegraphic communication, it is of the greatest importance. The effect appeared to be constant. It took place in the production of carbonates, iodides, chromates, and ferrocyanides; and finding myself beset with this unexpected difficulty, I applied for advice to two or three of the first chemists in London: but they were neither able to discover its cause, nor to suggest a remedy. After many fruitless experiments, I at length found that the suspension of action arose from the adhesive tenacity of a non-conducting crust of insoluble matter, which was precipitated upon the pole, and which almost entirely stopped the flow of the current. It therefore occurred to me, that if the product of decomposition could be rendered partially soluble, the evil would be avoided—and the event justified anticipation. Sulphates, nitrates, muriates, or dilute acids, when added in

moderate quantity to the different electrolytes which had previously been employed *per se*, produced a rapid succession of electric effects, without the slightest tendency to stoppage or impediment. Positive and negative results were produced in abundance, and basic substitutions of every variety effected with the greatest ease. Thus chromate of lead was instantly converted into chromate of iron—sesqui-ferrocyanide of iron into ferrocyanide of copper, and so on. And it mattered nothing in this case whether the original pigments were produced by ordinary precipitation or by the direct action of electricity. The great difficulty, in fact, was entirely overcome, and the remedies under the new principle were so numerous, that the only remaining question was one of choice. The mineral acids were found to be very effective in their action, but, for obvious reasons, they were only applicable under certain conditions. Neutral salts were found preferable for the lecture-table and the general purposes of ornamentation, as being not only good conductors of electricity, but having, at the same time, no tendency to stain or discolour the paper. The solution most commonly employed for illustrating these experiments at the Polytechnic Institution was ferrocyanide of potassium and nitrate of soda; and at the period of their exhibition, Mr. Bain was very commonly in attendance. He subsequently applied to me personally for further advice and information upon the subject of electro-chemical printing. I believed myself to be in a position of security, and I therefore answered all his questions without reserve or hesitation. Imagine what my surprise must have been, when Mr. Bain's new patent for an electro-chemical printing telegraph first made its appearance in your columns; for not only had he embodied my patent principle in this invention without leave, license, or acknowledgment, but he was actually using the very solution which he had so frequently seen me employ in my previous experiments, viz., yellow prussiate of potassa (ferrocyanide of potassium) and dilute sulphuric acid. Whether the facts which I am now stating are correct or otherwise, may be readily ascertained by a visit to the Enrolment-office, Chancery-lane, where my specification, like that of Mr. Bain's, is duly deposited, and where, also, like his, "it is accessible to the public at all times." The date of my patent for electro-chemical printing is 1841, as before stated; the date of Mr. Bain's first patent wherein this principle is embodied is 1848. I hope that those of your readers who are interested in this matter will examine and judge for themselves.

But it may possibly be assumed, that my process forms a very insignificant part of Mr. Bain's invention. Now the case is just the reverse; for, in addition to the general objections existing against the use of iodide of potassium as the subject of electric decomposition, it happens to be the very compound, as before observed, which had previously been used by Davey for the self-same purpose. Mr. Bain therefore falls back upon my principle as something new; and in consequence of the improvements already referred to, and which cost me so much thought and labour, he succeeds in printing some hundreds, if not some thousands of telegraphic symbols, in the space of one single minute; and having thus satisfied the Directors of the Electric Telegraph Company of the value and importance of his invention, he disposes of his patent upon most advantageous terms, which he could not otherwise have realized. I should not be thus explicit and circumstantial in my details but that Mr. Bain has, both by word and action, denied my right and title to that which I here claim as my own. I have waited a long time to see if he would render me even tardy justice in this respect; and as he has not done so, I now considerately lay these facts before your readers, and I beg leave, through the medium of your columns, to challenge contradiction as to their accuracy.

ISHAM BAGGS.

## THE GREAT EXHIBITION OF 1851.

Since this scheme was last under our consideration, there have been two public meetings held in London and Westminster, to promote the raising, by subscription, of the necessary funds for carrying it into effect, —both of them distinguished for the eminence of the speakers, the unanimity of the proceedings, and the success with which the begging box was put about. If it were

the custom for truth to be spoken at such assemblages,—if more than one side of any question were ever listened to at any of them,—one could not fail to be impressed with the most profound respect for these displays of popular feeling. But as it is, they only illustrate, to our minds, the exceeding ease, with which people can talk in any given sense, where they have neither dissent nor opposition to fear, and the blind servility with which high and low amongst us, are ever ready to follow in the train of rank and fashion.

If there be any, who want to know how much better it is, to cultivate the arts of peace than those of war—how beautiful a thing it would be, to see all nations at peace, and striving only to excel one another in works of charity and good will—and how good it is in Prince Albert to take the cause of universal civilization under his gracious protection,—if there be any who want enlightenment on such difficult points as these, they may read with profit to their understandings, the reported proceedings of these two meetings; but if they desire to know anything of the practical difficulties with which the subject is surrounded, or how any one of these difficulties may be removed, they may as well take counsel of Don Quixote, or go "a colonelling" with Sir Hudibras.

Among the speakers at the City of London Meeting—and as vapid as any—was Lord John Russel, the Premier. His lordship was at pains, however, to impress on the meeting that it was not as *Premier* he appeared amongst them, but simply as one of the members for the City; and the utmost he could pledge his Member-of-Parliament character for was, that "the Exhibition should be on a scale *commensurate with the importance of the occasion*"—as no doubt it should be, whether the thing were wise in itself or not.

"There needs no ghost, my lord, come from the grave
To tell us this."

But as Minister, he desired to be understood as offering no opinion whatever about the matter. Now wherefore this reserve? The Royal Commission for holding the Exhibition was countersigned by one of the Members of the Cabinet, and issued, of course, on the responsibility of the entire Cabinet. Why, then, should the chief of the Cabinet shrink so sensitively from identifying himself with it? Why, especially, since, according to one of the recitals of the Commission, "arts, agriculture, and commerce" are all alike to be benefited by the measure? The reasons for the Premier's fast and loose conduct at the City Meeting we take to be the same precisely with those which dictated that equally noticeable specimen of his lordship's statecraft—the omission of all notice of the Exhibition from the Queen's speech at the opening of Parliament. If Lord John and his colleagues had approved heart and soul of the project, it would have occupied, as a thing of course, a foremost place in their political programme. The Commission was an act of the Crown, of which the Crown owed at the first opportunity an account to Parliament, and of which, we may be sure, the Queen would have been proud to give an account—reflecting, as no doubt Her Majesty has been taught to believe it does, everlasting honour on its princely projector. When Her Majesty was expressing her happiness at "continuing at peace and amity with foreign powers," and her hopes of seeing, ere long, removed "those obstacles which have hitherto existed to a free intercourse between the nations of the world," what could have been more in place, than to say that, in order still further to promote these important objects, Her Majesty had, at the suggestion of her beloved Consort, issued her Royal Commission for holding, in the year 1851, an Exhibition of Works of Industry, which should be open to all nations, and at which large sums of money should be awarded in prizes to the most deserving of the competitors? All this was so natural to have said, had Her Majesty's Ministers but regarded the scheme with the same cordial approval as their Royal Mistress, that the omission to say it, can only be accounted for on the opposite supposition. Assume Lord John's support to be all sham, and the inconsistency is at

once explained. The ministry of Lord John is, *par excellence*, a ministry of compromise. Almost always half right and half wrong,—ever stopping short of the point to which principle and duty should carry them. Although willing enough that Prince Albert should ride his hobby—a harmless hobby at the worst, compared with the princely hobbies of other days and dynasties—Lord John had no mind to identify himself or his Ministry with it, as an act of State policy; for to have done so, would have compelled him to justify it in all its bearings, in the face of Parliament and the world; and this he knew well he could not do without shipwreck to his reputation as a statesman. To please, or, rather, keep well with the Court, he winked at the issue of the Commission, not fearing much to be called to account for so small a compliance with the wishes of his Royal Mistress: but to save himself and his Administration from disgrace, he cut it dead (as *Minister*) at the City Meeting, and would allow it no place in the Ministerial exposition to Parliament of the measures of the session.

For the same reasons which have dictated this abnegation of the scheme by Her Majesty's Ministers, the gentlemen of Her Majesty's opposition are also marvellously silent about it; leagued as they profess to be for the "Protection of Native Industry," they cannot in common consistency approve of it; yet they won't say a word in its disparagement, because that would be to offend the Court, without the favour of which there would be no chance of their achieving what the Duke of Richmond frankly avows to be their great object—to turn Lord John and colleagues out, and thrust themselves in. They, too, would be very willing that the Prince should be allowed to ride his hobby, provided only they have the administration of the loaves and fishes.

What, then, may be the circumstances or considerations which have frightened, and which still frighten, both the Whig Cabinet and their rival aspirants for office from identifying themselves with the scheme? Let us see:

First: there is that great blot on the face of the Commission which must have already grievously discredited it in the eyes of all other nations, whatever it may have done amongst ourselves. It is now notorious, though no doubt kept secret enough in the first instance from the Queen's advisers, that the Commission is founded on a series of recitals, all of which are untrue. A measure which, according to its eulogists, is to exalt immeasurably the character of the nation, is based on a bag of moonshine. The Commission recites that the scheme of the Exhibition was "proposed" by the SOCIETY OF ARTS, whereas all the world knows, for all the world has heard the fact proclaimed times without number, that Prince Albert was "the great originator of the undertaking" (Lord John Russell's words at the City Meeting). The Commission next recites, that the same SOCIETY OF ARTS have invested 20,000*l.* to be awarded in Prizes and Medals on the occasion—which is also admitted to have been never in any sense either literally or substantially true. The Commission further recites, that the same SOCIETY OF ARTS had "appointed" certain persons to be "treasurers for all receipts arising from donations, subscriptions, or any other source, on behalf of the said Exhibition," and certain other persons "to be the treasurers for all executive expenses;" and certain other persons to be "an executive Committee for carrying the said Exhibition into effect under the direction of our most dearly-beloved Consort"—not one of which three appointments THE SOCIETY ever made, or knew anything about till they saw them in the *Gazette*. And, finally, the Commission recites, that the said SOCIETY had also "besought us that we would be graciously pleased to give our sanction to this undertaking, in order that it may have *the confidence not only of all classes of our subjects, but of the subjects of foreign countries*;" of which beseeching THE SOCIETY are as innocent as of ever having set the Thames on fire. A very Mrs. Harris of a Society! Not as some people are maliciously wont to say, a society of

old women, but a perfect impersonation of marrowless, substanceless, shadowless old womanage. Of the whole recitals not one is true—all notoriously, undeniably, confessedly false.

The apologists of the Commission say that, though the Society did not, in truth, formally do any of the things ascribed to it, and were not in reality cognizant of any of them, yet that there were certain parties who represented themselves as acting in the name and on behalf of the Society, and who were considered by the Crown as so acting, who did propose, and invest, and appoint, and beseech, as the Commission avers they did; that the Society itself is but too proud to have such great doings affiliated to it (showing therein a weakness but too common to pretentious senility)—and that since the Society itself does not formally repudiate them, nobody else has a right to say anything.

Such a mode of defence evinces an exceedingly low state of moral feeling in those who use it. We need seek for no better commentary upon it than was furnished the other day by one of Her Majesty's own judges (Patteson) on the hearing of the case of Barber, in which the genuineness of a number of deeds was involved. One of the gentlemen of the long robe chose to treat with great lightness the offence of using a *nom de guerre* in the recital of a deed, when the Judge interposing observed:

"I cannot allow it to go forth as having my sanction, that there is nothing wrong in making a false recital in a deed.—*It is a practice which strikes at the foundations of all truth and justice.*"

The representatives of the Crown ought to have ascertained for themselves that the persons they were dealing with, were really what they represented themselves to be, and invested with powers such as they pretended to exercise. And they cannot now be allowed to plead their own gross neglect of duty as an apology for their having suffered the honour and dignity of the Sovereign to be sullied by an alliance with trickery and imposture.

But, *secondly*, the Crown has dealt with the sham nomination by the Society of Arts of certain persons to be an "Executive Committee in the premises;" as if it were an actual matter of fact, and invested these persons with all the functions and powers of a real executive. It is much as if Her Majesty had, on the recommendation of Sarah Gamp, included Mrs. Harris in the Commission of the Peace.—Who are these parties?

Are they such as one might expect to see picked out, to be placed at the head of a grand public undertaking such as this professes to be? Men among the most eminent of their day in art, or science, or letters? Men not only well known and highly esteemed in their own country, but of European, at least, if not of world-wide reputation? Individuals whose names require but to be mentioned to inspire confidence, "not only in all classes of our subjects, but of the subjects of foreign countries"? *Risum teneatis, amici?* Their names are HENRY COLE, CHARLES WENTWORTH DILKE, JUN., GEORGE DREW, and FRANCIS FULLER, with one MATHEW DIGBY WYATT for Secretary;—five as obscure individuals as could well be got together in one group—not such even as you might impress from the streets, but such as could only be found out by poking into sundry holes and corners after them,—people distinguished for nothing whatever in the world,—people whom nobody knows—never heard of, either in their own country or out of it. Persons, too, who, if not the very same who falsely passed themselves off as the representatives of the Society of Arts, have been put forward to reap the benefits of the fraud practised on the Crown,—the nominees of impostors, if not impostors themselves! How is it possible that such "an Executive" can inspire either respect or confidence? Or how is it to be expected that any great party in the state would choose to identify themselves with a such pack of characterless nobodies?

[We have purposely left out the name of Mr. Robert Stephenson from the Executive batch, because it was notoriously added at

the last moment, for the sake of garnish merely, and after an express intimation from that gentleman that he could lend them his name only.*]

We do not forget that the Executive is stated to be "under the direction of our most dearly beloved consort;" but we remember, also, too well what has befallen other Commissions with similar Executives placed under similar nominal control, to have the least reliance on the protection that affords. The Prince can hardly be expected to watch over the affairs of the proposed Exhibition with more vigilance and care than the Right Reverend and Right Honourable Members of the Ecclesiastical Commission did over those confided to them; and yet all that vigilance and care has not prevented the trust referred to, from being most grossly and scandalously abused.

*Thirdly*. The Exhibition proceeds on the principle of granting large sums in prizes and medals to the most meritorious of the Exhibitors. We have on a previous occasion stated many objections to this principle (*ante*, p. 53), but we must, even at the risk of repeating ourselves on some points, go over the whole subject again.

Prizes can only operate beneficially when bestowed on the best of the class of articles for which the prizes are offered. But you can never be sure that those exhibited are the best of their class; on the contrary, you may be quite certain that some, if not many, of the first-class manufacturers will not exhibit. You run the risk, therefore, of awarding prizes to articles of very inferior merit, to which your decisions will give a fictitious and misleading value in the eyes of the public. You cannot help this, do what you will. Custom will be diverted by your jackdaw awards into new channels, to the unmerited injury—possibly ruin—of old and established centres of business—of many a now industrious and thriving fellowship and community.

Some prizes, of course, there may be, fairly earned and impartially awarded—very possibly many. What then? The competition is to be open to all nations. Other nations will, of course, carry off their share; and whatever is gained by others must be so much lost to ourselves. Abstractly, it may be quite right that superior ingenuity, of whatever country or clime, should carry the day. But men do not form themselves into states and communities, to promote ingenuity or anything else in the abstract. Each people seek, from combination and union, the better to develope their own genius and industry in preference to everybody else's—to aid and support one another against all and sundry—to exalt the common name above all other names. And very plain it is, that if every nation will be only true to itself, the good of the greatest number of nations, and the interests of humanity at large, must be thereby promoted. For there is nothing in such nationalism to forbid between nations, any more than between individuals, that friendly competition which is the great spur to excellence in all things; all that it forbids is, the encouragement by governments of the industry of aliens, in preference to and in disparagement of, that of their own subjects. If the cosmopolitanism now in vogue were allowed its full swing, it would amount to this: that if there is any branch of manufacture—cutlery or hosiery, for example—which any other people can produce better than we, it will be sound policy in us to bring out the fact as clearly, and distinctly, and publicly as possible, in order that our goods may no longer enjoy that reputation in the markets of the world which they have hitherto undeservedly done! But where is the minister who would undertake to maintain such a proposition as that before a British House of Commons—in the face of the representatives of Birmingham, and Sheffield, and Nottingham, and Leicester?

Englishmen are but too prone to think that they have nothing to fear from competition—that as they have beaten the world in arms, so also they can beat it in the arts of peace; and well this foible has been played upon by the missionaries whom Prince Albert has sent round the country to dis-

* Mr. Stephenson has since resigned, and been replaced by Lieut.-Col. W. Reid, R.E.

seminate his Quixotic, notions of universal brotherhood. "You're not *afraid*, are you, of being beaten?" The idea of objecting from fear to the throwing of the competition open to all nations, has everywhere settled the question with our stout-hearted and simple-minded workmen. Much or little, however, something they must suffer from it; they cannot expect to win all the prizes, or even a majority of them; and they must of necessity lose in reputation by all that are awarded to others. Your sentimental cosmopolist, who cares no more for the Englishman in such a struggle than for a Hottentot or Hindoo, may view such a result with complacency; but every man who is not above loving his country before all countries, must see with deep regret his countrymen entangled by a spurious philanthropy in so losing a game.

We hear much of the tendency of the measure to conciliate foreign nations. No doubt foreign nations must feel vastly obliged to us, in the first instance, for jeopardizing the interests of our own artizans in order to befriend theirs; but how long beyond the Exhibition may their gratitude be expected to last? If the English obtain the majority of the prizes (as it is to be hoped they will)—if the general result be only to establish more firmly than ever the superiority of the English in manufacturing skill, the natural and inevitable effect must be, to fill the breasts of the foreign competitors with feelings of mortification, enmity, and bitterness. If, on the contrary, the majority of prizes should be awarded to foreigners (which God forbid!) such an event will plant a thorn in the side of manufacturing England, which it will take ages to eradicate. Talk of conciliation, forsooth! Say rather, that by favour of the Prince, a method has been hit upon of setting nations by the ears, which beats all others on record to nothing.

But, lastly, assuming for argument sake that it would be a possible thing to have regard to merit alone in the award of the prizes—that you sacrifice no duty to your country in encouraging by pecuniary largesses the development of foreign industry, you must have judges to award the prizes in whom all the world will have confidence. But where are such judges to be found? How are they to be selected? And who is to select them? Since the exhibition is to be open to all nations, it would be only fair that all nations should have a voice in the appointment. It would hardly do to have them all English—or even half English and half foreigners (as in criminal cases). You must have a sprinkling of a much larger variety if you would expect the world to give you credit for acting in a fair and honest spirit. France, of course, would have a clear right to be largely represented; so also would Brother Jonathan, with his lots of "smart notions;" Belgium and Switzerland would expect not to be forgotten; and even John Chinaman might think the chance of equal justice but small, if there were not some long tail to wag on his behalf. But, supposing this principle of national representation to be admitted—as admit it you must—how are the representatives to be chosen? How, indeed! The thing is evidently not to be done. The necessity you are under of having an ostensibly neutral and impartial tribunal, lands you in an impossibility, You cannot have the sort of tribunal which the professed character of your scheme requires; and failing that, you must either abandon the scheme altogether, or have recourse to some tribunal, the constitution of which will be a mockery of all propriety and fairness.

## ON RAILWAY CARRIAGE AND WAGON SPRINGS. BY MR. W. A. ADAMS.

[From Proceedings of Institution of Mechanical Engineers, January, 1850.]

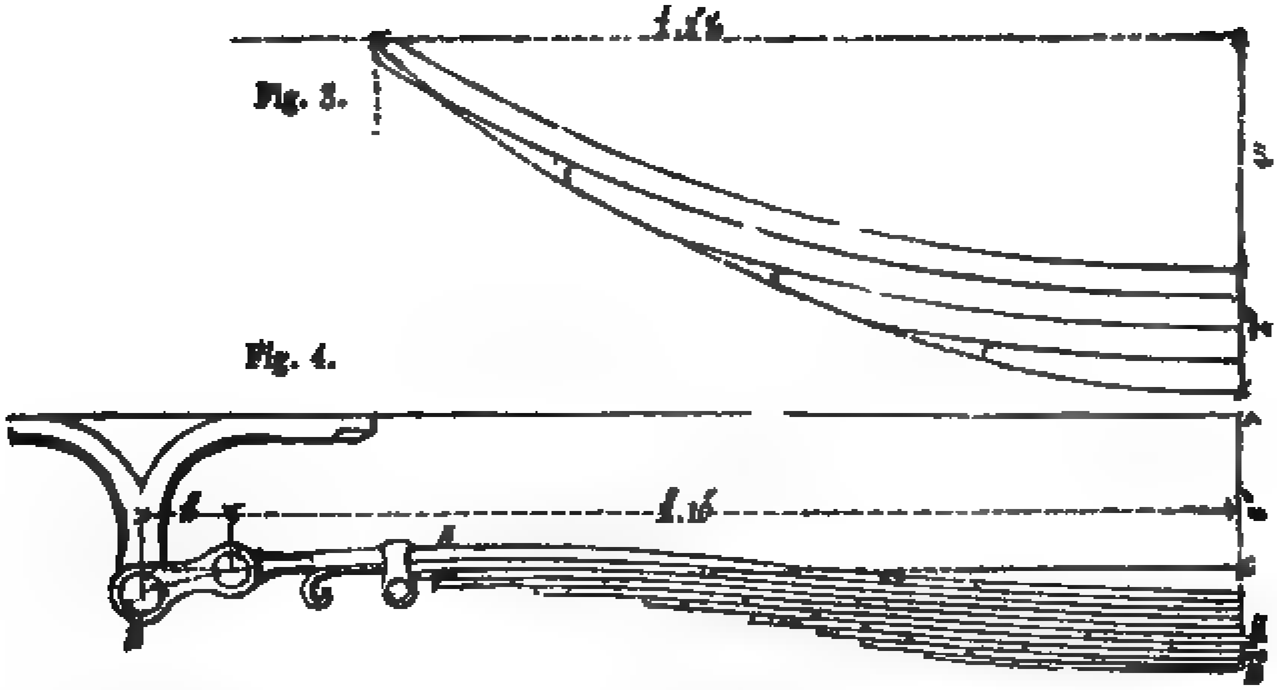
The object of this paper is to discuss and analyze the various forms and descriptions of springs now in use in Railway Carriages and Wagons, pointing out, to the best of the writer's knowledge and experience, their advantages and defects, and suggesting such improvements in the datails as will lead to better effect and economy in the use and manufacture.

Buffing and bearing springs are applied to carriages and wagons in order to absorb and

neutralise as far as possible the force and momentum of the shocks to which the vehicles are exposed in their ordinary work. A perfect bearing or buffing spring would be that which would absorb the entire power and space of the blow without disturbing

Fig. 3.

Fig. 4.



the inertia of the vehicle. This in practice is wholly impossible, from the varying loads on bearing springs and varying force on buffing springs. In bearing springs the nearest approach to perfection is in the modern first-class carriage, where the dis-

proportion of total weight between loaded and unloaded is less than in any other vehicle.

At the present time, as far as the writer is aware, there is no rule or formula by which engineers or manufacturers can ascertain the true form, weight, or quality of material to be used for effectually springing a railway vehicle, and consequently the goods and mineral traffic of the country, averaging from 35 to 40 cwt. per spring, is now carried on springs which vary in weight from 35 to 110 lbs. each.

The primary object being in all cases to discriminate between good and bad material, the writer has endeavoured to test the relative quality of spring steel converted from Swedish and from English iron. For this purpose bars of ordinary spring steel were procured from various makers, some being English and the others Swedish; the bars were all 3 inches wide and $\frac{4}{16}$ inch thick. These bars were cut to equal lengths, marked, and then made into springs and tempered in the ordinary manner; each of the springs consisting of a single plate turned over into an eye at each end, and 18 inches long between the centres of the eyes. These springs were then proved in the presence of Mr. W. P. Marshall, by means of pressure applied at the centre of each spring, the spring being supported by a pin passed through the eye at each end, which rested on rollers, to allow the ends to be drawn together freely when the spring deflected.

The results were as follows:—

ENGLISH.

| No. | Weight. | Deflection. | Permanent. Set. |
|---|---|---|---|
| 1 | 15 cwt. | 1 inch | no set. |
| | 20 „ | | ⅛ inch. |
| | 25 „ | Broken | |
| 2. | 15 „ | 1⅛ inch | no set. |
| | 20 „ | 2¼ inch | 1 inch. |
| | 25 „ | Broken | |
| 3. | 15 „ | 1¼ inch | ⅛ inch. |
| | 20 „ | 3⅛ inch | 2½ inch. |
| | 25 „ | much set | |
| 4. | 15 „ | 1⅝ inch | ½ inch. |
| | 20 „ | 2⅝ inch | 1⅝ inch. |
| | 25 „ | much set | |

SWEDISH.

| No. | Weight. | Deflection. | Permanent. Set. |
|---|---|---|---|
| 5. | 15 cwt. | 1¾ inch | ⅜ inch. |
| | 20 „ | 3½ inch | 2⅜ inch. |
| | 25 „ | much set | |
| 6. | 15 „ | 2¾ inch | 2⅛ inch. |
| | 20 „ | Broken | |
| 7. | 15 „ | 2⅜ inch | 1⅜ inch. |
| | 20 „ | 4½ inch | 3⅜ inch. |
| | 25 „ | much set | |
| 8. | 15 „ | 2⅜ inch | 1 inch. |
| | 20 „ | 5⅝ inch | 4¼ inch. |
| | 25 „ | much set | |
| 9. | 15 „ | 2 inch | ¾ inch. |
| | 20 „ | 3¾ inch | 2⅜ inch. |
| | 25 „ | Broken | |
| 10. | 15 „ | 3¼ inch | 2 inch. |
| | 20 „ | Broken | |

From the foregoing experiments it appears that the elasticity, sustaining power, and toughness of the English steel was much greater than that manufactured from the Swedish iron.

The *Laminated Spring* is the most common form for the springs of railway vehicles, consisting of a number of plates, the taper being given by reducing the plates successively in length.

The principle for regulating the doper of the spring is to obtain an equal amount of strain or deflection from each particle of material. If some parts of the spring are deflected less than others, the amount of material might be reduced in those parts without impairing the sustaining power of the spring.

A laminated spring may be tapered either in breadth or thickness, but if parallel in thickness, and all the plates the same length, each plate should be uniformly tapered in breadth, so that each half of every plate would be a triangle. In practice the plates of laminated springs are made parallel in breadth and thickness, inasmuch as the parallel bar is the most economical form, and the taper is obtained, as before expressed, by the different lengths of plates.

If a spring consisted of only one plate parallel in breadth, but tapered in thickness, such taper should be in the form of a parabola, as the strength is in proportion to the square of the thickness. This form is shown in fig. 2, by the part A A.

Fig. 1 represents one-half of an ordinary wagon-bearing spring. Fig. 2 is the same spring pressed flat, but supposing the plates not to slide over one another.

If the spring consisted of a number of very thin parallel plates, the correct form would be a uniform taper in thickness from the centre towards the ends, because the strength of each part of the spring would depend upon the number of plates at that past. In practice the most correct form of spring is between the two forms of the triangle and the parabola, but is nearer the triangle, as the thickness of the plates bears only a small proportion to the average length.

The spring shown in fig. 1 is 3 feet 6

inches long, 3 inches wide, and $3\frac{1}{8}$ inches thick in the centre, and consists of 15 plates $\frac{5}{16}$ inch thick, excepting only the outside plates, which are $\frac{3}{8}$ inch, according to the usual practice, to allow for the plate not being supported by plates on both sides.

Fig. 5.

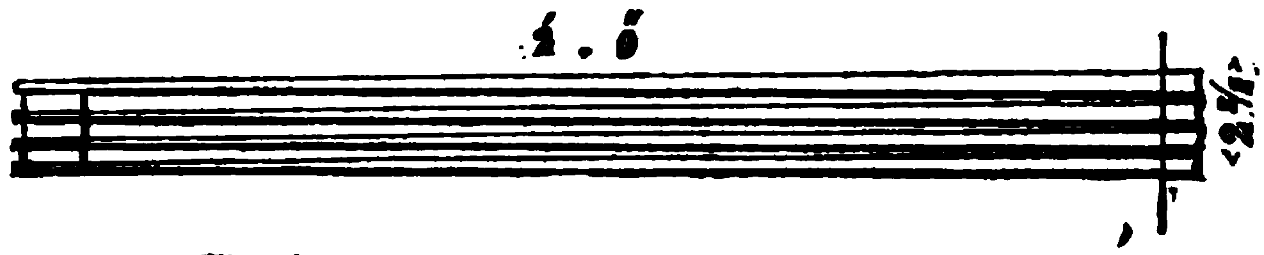
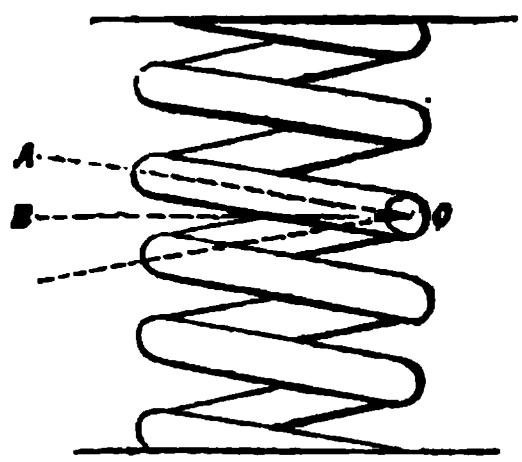


Fig. 6.



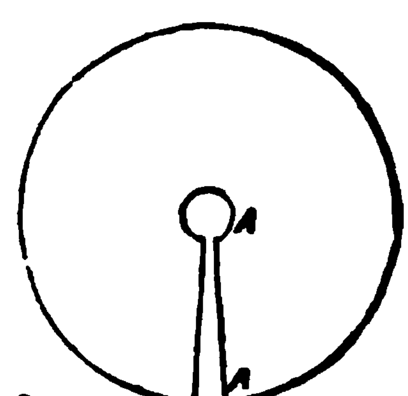


Fig. 7.

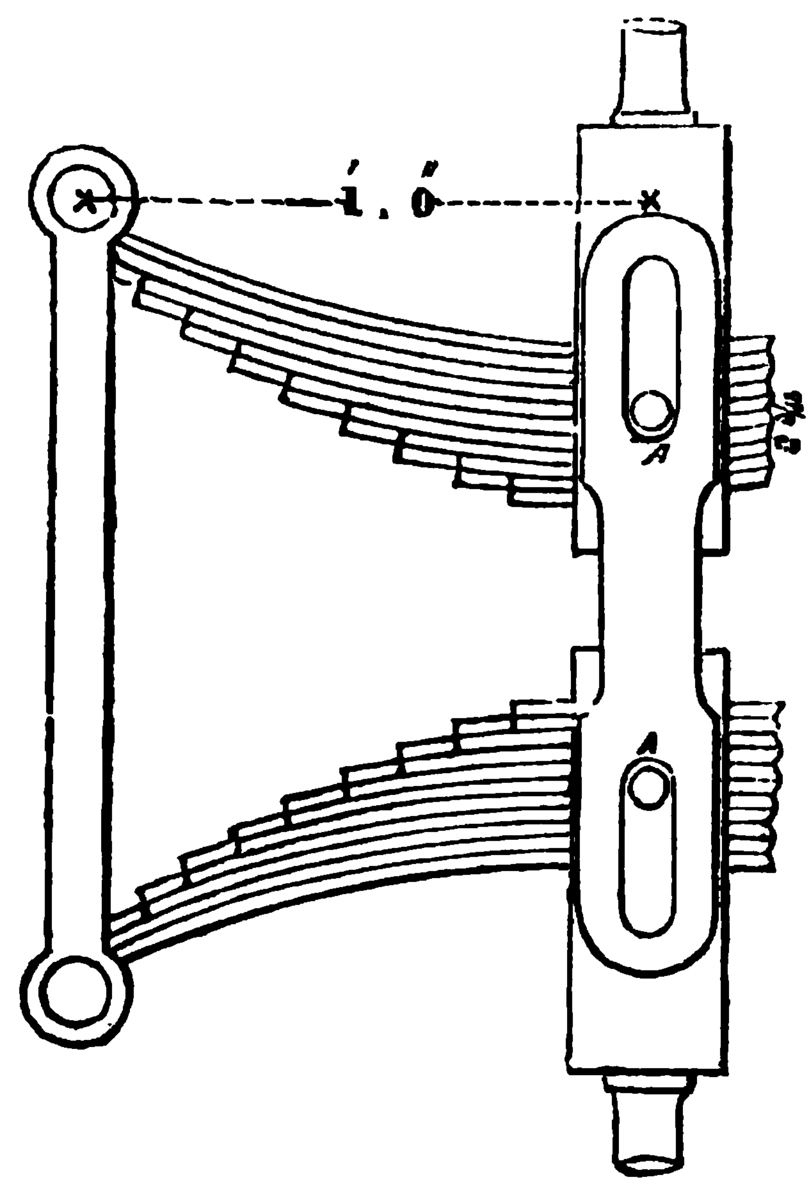


Fig. 8.

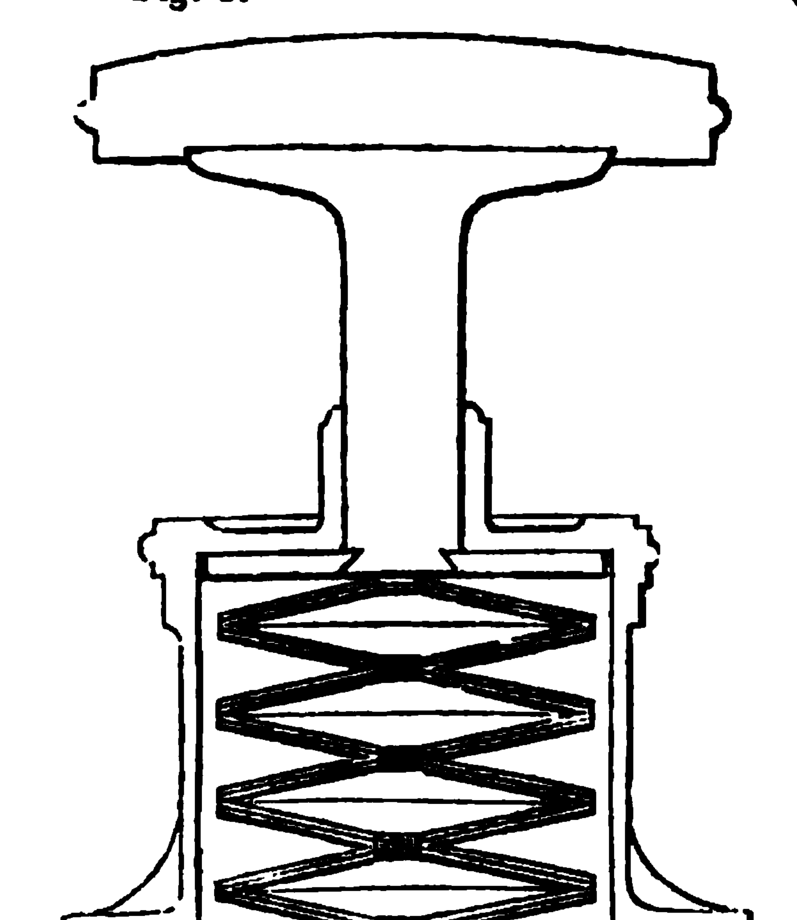
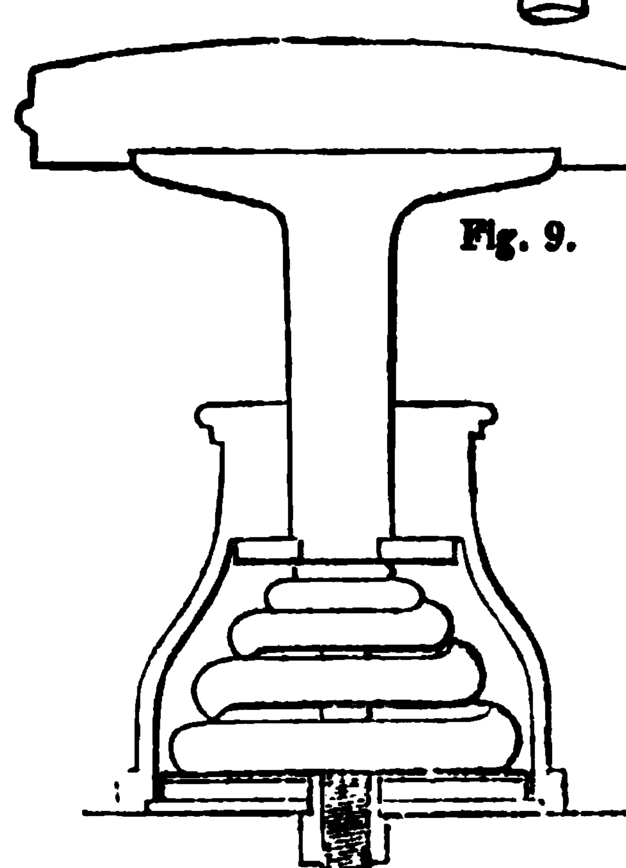


Fig. 9.



If this spring were a single plate of the same total strength it would be only $1\frac{1}{4}$ inch thick at the centre, and in the form of the parabola, A A, in fig. 2, but as it consists of a number of places the outline must be a line beyond that curve.

The straight line B B, fig 2, is drawn outside the curve, giving a uniform taper from the centre of the spring to the end of the second plate, leaving the top plate its full thickness to the end. This line B B, appears suitable to be adapted for the practical outline of the spring, as the deviation from correctness is only very small and gives a slight diminution in strength at the quarter length D, which is advisable in practice, because the centre C is usually weakened by a $\frac{3}{8}$ inch rivet hole reducing the strength one-eighth at that point.

The line B B, is transferred from fig. 2 to the curved spring in fig. 1, by dividing the length of the top plate into 16 equal parts by the lines from 1 to 16, which are drawn vertical in fig. 2. and radiating to the centre of the curve of the spring in fig. 1. These lines being made of equal length in both cases give the curved line B B, in fig. 1. The end of the top plate is lengthened and turned down at E to give a bearing to the spring.

The writer has in practice set out all springs required by him, by drawing through the extreme points C and E, a circular arc of the same radius as the top plate of the spring. The line obtained by this method is a singular instance of how near practice has approached theory by this simple method, the extreme difference being only one-eighth of an inch.

The line H H, is obtained in the same manner as before described, excepting that the spring is not tapered to the centre, but to a set-off of 2 inches from the centre, viz., from C to H. This is the form universally adopted, but it is clearly incorrect, as the centre is made proportionately weaker than the remainder of the spring, as well as being further weakened by the rivet-hole through the centre.

The true and correct form of spring would be, that the centre of the spring should be at H, and the plates connected not by a rivet, but with a narrow hoop. In practice the spring is clipped to and bears on the axle-box at H, and consequently the mass of steel H to C is entirely wasted.

In two plates of steel of the same length and breadth, but of different thickness, the amount of deflection caused by the same weights is in proportion to the cube of the thickness, although the breaking strength is in proportion to the square of the thickness; consequently, if one spring were made with plates double the thickness of those of another spring, the first would require only one-eighth the number of plates, viz., one-eighth the weight of material to support the load with the same amount of deflection; but in that case the extent of the displacement of the particles of the steel in the thick plates would be double of that in the thin plates, and in the practical application of thick plates to springs it is necessary to limit the deflection within the above extent, as the double amount of deflection would break or strain the particles, presuming that in the thin plates the particles were being strained to a reasonable extent.

The *Wagon Bearing Spring* in ordinary use on the Midland, London and North Western, and other railways is shown in fig. 1, and is 3 feet 3 inches long, 6½ inches camber. $4\frac{13}{16}$ inches thick, and 3 inches wide, consisting of 15 plates, of which two are three-eighths of an inch, and the rest $\frac{5}{16}$ of an inch thick, and the spring averages in weight about 93 lbs.

This spring is used to sustain loads not exceeding six tons on the four springs exclusive of the wagon body; the wagon body weighs barely two tons,—making the total load about eight tons, or two tons per spring.

By actual experiments this spring deflects with

1 ton ...... 2 tons ...... 3 tons
$\frac{7}{8}$ inch ...... 2 inches .... 3¼ inches

and will prove flat without setting or breaking.

It is to be noted that in originally proving this spring flat it had set about three-eighths of an inch, but that with the same extent of proof it will not again permanently set, having this property in common with other materials.

This spring would well sustain a load of 3 tons in actual work, as the concussions received upon the rails would probably not at any time increase the deflection half an inch, consequently the load of two tons is being sustained on a spring far too rigid, to the detriment of the road and the wagon, and the original first cost is considerably more than it need have been.

Formerly various plans were adopted to lessen the friction at the ends of the springs by the use of rollers; but these plans are now obsolete, the amount of friction not being found practically detrimental.

The points of the plates of laminated springs were formerly tapered in thickness, but now the usual plan is to form the taper in the breadth by cutting the plates at the ends in a triangular form. This method is found much more certain in its effect, is neater in appearance, and cheaper in manufacture. The cutting is generally performed either with the shearing machine or between dies in a punching machine, the scraps being used in the melting pot for cast steel.

Fig. 3 represents the *Wagon Bearing Spring*, or more correctly speaking *prop*, in

extensive use on the North Branch of the London and North Western, the South Staffordshire, Caledonian, and other railways, which may well be designated by the term *cheap*.

The spring is 2 feet 5 inches long, 4 inches wide, 2 inches thick, camber 4 inches, consisting of four plates half an inch thick, and weighs about 40 lbs. Actual experiment furnishes the following deflections :—

1 ton ...... 2 tons ...... 3 tons
$\frac{3}{8}$ inch...... $\frac{3}{4}$ inch ...... $1\frac{1}{8}$ inch,

The cause of the immense sustaining power of this spring has been explained before in the observations on thick and thin plates.

The writer has already endeavoured to explain that the ordinary spring (fig. 1) is too rigid, what therefore must be the wear and tear of rails, wheel tyres, vibration to the axles, and general wear and tear to the wagon and load caused by the rigid spring. Compared with fig. 1, this spring affords less relief in the proportion of 6 to 16, and is the furthest removed from the object required to be attained.

The *Wagon Bearing Sgring* in extensive use on the Midland, Great Western and other Irish railways, and on the London and North Western Railway, is the ordinary spring, as in fig. 1, but with eyes rolled at the ends and hung on scroll-irons.

The advantages of this form of spring are the great space passed through and quickness of adaptation to the inequalities of the road, in consequence of the deflection of the end shackles caused by the deflection of the spring, and consequent elongation between the centres of eyes of shackles ; also the rubbing friction at ends is almost entirely obviated.

The disadvantages are first, that to carry a given load a much greater quantity of material is required, as from the circumstance of a great portion of the space between the sole-bar and the axle-box being taken up by the scroll irons and shackles the radius of the curve of the spring is much reduced, and a thicker spring consequently required.

Secondly, the tension on the sole-bars tending to hog the wagon frame, being the reverse of the action of the ordinary spring.

Thirdly, in consequence of the great space passed through by the deflection of this spring, the variations of the load will considerably vary the height of the buffers from the rails.

Fig. 4. represents the now universal *Carriage Bearing Spring* originally introduced by Mr. Wharton on the London and North Western Railway, as the result of repeated practical trials and improvements ; theory would probably have never attained a similar result.

This spring is 5 feet 3 inches long, 3 inches wide, $2\frac{13}{16}$ inches thick, and consists of nine plates $\frac{5}{16}$ inches thick ; the ends of the plates are what is technically termed long spear-pointed.

Fig. 4 represents the spring when loaded, and the peculiar camber before fixing is made by setting the plates entirely at the centre, instead of the plates being set into a curve throughout their whole length as in other springs. In fixing this spring the tension-brace is adjusted between scroll irons, with intervening compensating shackles. The tension-brace is 3 inches by three-eighths of an inch, and thickened at the ends to five-eighths of an inch. The spring is then compressed between the axle-box and the brace.

The action of the spring and brace is that of a lever spring combined with a tension-brace, but the spring is so thoroughly overpowered by the leverage of the brace and the weight of the load, as to have little or no power of reaction or displacing the inertia of the load, beyond that of recovering its original position, thus affording the well-known smoothness and steadiness of action of this construction of carriage spring.

The brace is acted upon principally at the point A, but nevertheless when the blow from the road strikes the point B, and the spring and brace straighten at that point, the curving and straightening of the brace at A is compensated by the straightening and lengthening at C, the amount of tension at D being thus at all times about the same. The tension brace steadies and counteracts the power of the spring, and the spring partly relieves the brace by sustaining it at A.

This combination also affords the means of firmly attaching the axle-box to the spring and brace, and thus holding it independent of the axle-guards, which in this case are wholly *guards*, not *guides*, the guards neither touching the axle-box on the edge or side. Thus the effects of the inequalities of the road, laterally and horizontally, are only transmitted to the body through the elastic medium of the spring.

Springs of the same construction, but shorter and lighter, are now generally used for horse-boxes, carriage-trucks, and break-vans.

*Buchanan's Bearing Spring* consists of four flat horizontal plates 4 feet long, 4 inches wide, and tapered in thickness from half an inch at the centre to a quarter of an inch at the ends, and fastened in the centre and impinging at the ends only. See fig. 5.

It does not seem to possess any advantage over the ordinary laminated spring, excepting that the friction between the plates is entirely avoided except at the ends ; but

at the same time it must be borne in mind that in ordinary laminated springs the steel is rolled concave, therefore the plates bear at the edges only, which very considerably reduces the friction.

The disadvantages of this spring appear to be, firstly, that the extreme points of support are when the spring is weighted considerably below the centre bearing, necessitating the use of deep scroll irons in carriages and bearing blocks in wagons.

Secondly, the manufacture is costly and uncertain, from the fact of the plates being tapered in thickness and the difficulty of hardening and tempering plates that taper in thickness.

Thirdly, when fixed with scroll-irons the sustaining power is partly derived from its effect as a tension brace.

*Adam's Bow Spring* of the size used for passenger vehicles is 6 feet long from centre to centre of spring eyes, and the versed sine about 14 inches when weighted; the plates are 8 inches broad in centre and tapered in width to 5 inches at the eyes, and the thickness is $\frac{9}{16}$ inch.

The advantages of this spring are—

Firstly, it holds the axle-boxes without the intervention of the guards in the same manner as previously described with reference to the carriage-bearing spring.

Secondly, that the top links permit the wheels, axles, and axle-boxes to traverse laterally in passing curves and other impediments.

Thirdly, that the quick adaptation of this spring to lateral and perpendicular blows preserves the inertia of the body almost wholly from displacement at moderate speeds.

The disadvantages are, that at high speeds and on a bad road the reaction of this spring is so great as to cause a rebound, and the gradually increasing momentum from each successive blow occasions very considerable oscillation.

This property has completely negatived its use for four-wheeled carriages; but it is now used successfully under the eight-wheeled carriages on the North Woolwich branch, and there works to considerable advantage, permitting the wheels to adapt themselves freely to the curves of the road. The oscillation is there almost wholly obviated, from the fact that the blows are received upon eight points, and that the reactive power of a blow on one of the eight points is not sufficient to disturb the inertia of the load.

This spring has been, and is now used to a very considerable extent on six-wheeled carriages in Germany; but it is to be observed that the speed on the Continent is generally slower than in England.

*A Spiral Bearing Spring* is represented in fig. 6. The dimensions of these springs as used under the tenders of the Midland Railway were 9 inches height and 6 inches diameter, and they were made of seven-eighths of an inch round steel. Within this coil was fixed a second spiral of smaller diameter, coiled the reverse way to prevent the coils interfering.

The action of a spiral spring is principally torsion of the steel bar through the angle ACB, and partly lateral deflection from the increase of diameter when the spring is compressed.

Practically, the writer is not well acquainted with the use of these springs, but presumes that the following objections have been found in practice: the spring bears upon the sole-bar at one point, viz., over the centre of the axle-box, instead of at two points some 3 feet apart. There is a much greater uncertainty in the degree of elasticity and supporting power than in flat springs composed of many plates, partly from the greater thickness of steel causing uncertainty in the tempering, and from the greater angular strain on the particles of the steel; the sudden blows experienced by railway springs requiring the thickness of the steel to be within a certain limit, say of three-eighths of an inch, or half an inch.

*Buffer and Draw Springs.* The ordinary laminated buffer and draw spring is 5 feet 4½ inches long, $5\frac{7}{16}$ inches thick, and 3 inches broad, consisting of seventeen plates, the outside plates three-eighths of an inch thick, and the remainder $\frac{5}{16}$ inch; the camber when at rest being 13 inches. The same principles of construction apply to this spring as to the laminated bearing spring in fig. 1.

These springs are generally fixed in the centre of the carriage, sliding between four bars of iron, ordinarily termed the "buffer-spring cradle." The ends are acted upon by the four buffer rods, and the draw bar is cottered to the centre of the spring. The same methods have been tried to obviate friction at the ends as have been already mentioned with respect to bearing springs, but these plans are now obsolete.

In fixing the springs on carriages they are generally compressed one inch, and in wagons to the extent of about one-third of the stroke. The stroke of the buffer rod is limited to such an extent as will not deflect the spring beyond a straight line.

The sustaining power of this spring is equal to about 2 tons 14 cwt., or equal in all, including both ends of carriage, to about 2¾ tons, developed through a stroke of 2 feet.

As yet this method of buffing has not been surpassed or equalled, as none of the modern substitutes will give this moderate

amount of resisting power developed through so great a space as 2 feet; also the weight of the buffer springs being in the centre of the carriage, and the springs acted upon by long buffer rods, cause the action to be very steady.

The *Double Draw Springs*, with a check bar to limit the action within the straining point make probably the only truly effective method yet adopted. It is to be observed that the springs when drawn home are limited in their action by the check bar A A, thus forming a continuous rigid draw bar. See fig. 7.

The springs are each 2 feet long, $3\frac{9}{16}$ inches thick, and 3 inches wide, consisting of 11 plates, of which two are three-eighths of an inch thick, and the remainder $\frac{5}{16}$ inch; the camber is $3\frac{1}{2}$ inches before fixing; the springs are each compressed half an inch in fixing. The method of fixing is the same as already described for the laminated buffer spring.

*External Buffers.* Within the last few years a considerable number of external buffers have been introduced, consisting of a cylinder and piston packed with nearly every available elastic substance, and practically varying only in the material of the packing.

*De Bergue's Buffer Spring* is packed with rings of vulcanized India-rubber; there are four rings $5\frac{1}{2}$ inches diameter, and $1\frac{3}{4}$ inch thickness each.

In the opinion of the writer this is the least effective of any yet produced, as the stroke is very short, and then only moderately developed under enormous pressure. It is questionable whether in the event of a collision the train would not collapse and leave the rails, before the immense sustaining power of these springs was fully developed.

This buffer has an apparent stroke of about 3 inches; but it appears that to drive up the pair of buffers $1\frac{1}{2}$ inch would require a force of three tons.

By reference to the description of the ordinary laminated spring, it will be observed that the stroke is 12 inches with a force of $2\frac{3}{4}$ tons; being eight times the length of stroke with a rather less force.

It is also questionable whether the vulcanised India-rubber is of that imperishable nature originally supposed. The writer has had in his possession a considerable quantity of vulcanised elastic bands for papers that have become completely rotten.

*Todd's Cork Buffer* is as nearly as possible the same as De Bergue's, excepting that the packing is cork; there are five plates of cork $7\frac{1}{2}$ inches diameter and three-fourths of an inch thick each.

This spring appears to be superior to De Bergue's, inasmuch as the cork is more compressible than the vulcanised India-rubber, but it is questionable whether the cork is not liable to a permanent set.

*Adam's Disc Buffer* has the packing consisting of sixteen disc springs made from flat circular plates of steel 8 inches diameter, and one-eighth of an inch thick, with a radiating piece AA cut out to enable the plates to be pressed to a conical form. See fig. 8.

This buffer spring is superior to the foregoing, inasmuch as the total amount of stroke is wholly developed, and the power can be properly adjusted by the thickness of the plates; the total length of stroke is $5\frac{1}{4}$ inches.

*Webster's Air Buffer* exhibits considerable ingenuity, but is more complicated than the other plans. The air piston is 6 inches diameter, and the leather packing is distended by a vulcanised India-rubber ring; the length of stroke is 4 inches.

In the event of leakage during the stroke, the piston would not return to its original position, and to effect this a small spiral spring is employed which drives back the piston. A small valve admits air at the time that the piston is recovering its position, to compensate for leakage during the stroke.

*Spiral Buffer and Draw Springs* are used to some extent, but they are liable to the same objections already described with reference to the spiral bearing springs.

*Brown's Conical Spiral Spring Buffer* appears to be the least objectionable of these; it is shown in fig. 9. The resisting power is that of a spiral spring made in the form of a cone $7\frac{1}{2}$ inches diameter at the base, and the spring has the advantage of rotating at the point of the cone, thereby considerably easing the tendency to fracture or strain the particles of the steel; the steel is 1 inch wide and five-eighths of an inch thick at the base of the conical spiral, and is tapered for the last three coils to half an inch diameter at the point of the cone. When driven home the spring forms a complete flat volute.

The sustaining power of the spring is about equal for the space passed through to that of the ordinary laminated buffer spring, but with a shorter stroke, the length of stroke being only $3\frac{1}{4}$ inches instead of 12 inches. From its compactness and comparatively moderate price, it is, in the writer's opinion, should the springs be found to stand their work, the most eligible of the external buffers, but yet far from equalling the result obtained by the use of the laminated buffer spring and buffer rods.

The whole of the cylinder and piston buffers are liable to the defect of the piston being guided through only a short length,

and consequently they cannot work with the smoothness of the long buffer rod guided in several places. This more particularly applies in the event of an oblique blow upon e buffer.

In conclusion, it is suggested that it would be desirable for a correct Table to be formed of the sizes, weight, sustaining power, and deflection of laminated bearing and buffing springs, as a uniform guide in their practical application.

The writer proposes, should it be desired by the meeting, to prepare a laminated wagon bearing spring, with axle-box and adjustments complete, on the principles pointed out at the commencement of this paper, viz., to obtain the present amount of efficient results with the smallest quantity of material.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING FEBRUARY 28TH, 1850.

FREDERICK CHAMIER, Warwick-street, Middlesex, Commander R.N. *For improvements in the manufacture of ships' blocks.* (A communication.) Patent dated August 23, 1849.

The object of this invention is to construct lighter, cheaper, and more durable ships' blocks, either of wood or metal, than those in ordinary use by substituting wire for the ordinary rope strapping, and by constructing the cheeks of two thin metallic sheets, soldered and riveted together—one being flat and the other concave—with the space between them filled in by a suitable hot fluid substance, which hardens when cold. The strapping is composed of strands of wire rendered inoxydizable by being coated or painted, which are passed a sufficient number of times round both cheeks and over a ring, and then tied together between the ring and the block. In some cases it is proposed to form the strapping so as to carry the pin on which the sheave turns, whereby the cheeks will be relieved from strain, and consequently prevented from splitting; and to place a ring between the lower part of the block and the strapping, which is tied together as before. Lastly; the sheave itself is to be composed of three metal discs, the outer ones being bent, and having their ends turned over to form the groove for the rope, while the centre one is kept straight. The bouche is composed of pieces of metal or leather of a polygonal form.

*Claims.* — 1. Strapping wooden blocks with wire prevented from oxydizing by any suitable means.

2. The use of metallic strapping so constructed and placed as to hinder the splitting of the block.

3. Making blocks of sheets of any metal, rendered inoxydizable, instead of wood.

4. The manufacture of sheaves of sheets of metal, with either leather or metal bouches.

[The drawings which accompany this specification are executed in the most slovenly manner, and appear to have been originally six sets of tracings belonging to a French patent, which have been pasted on one sheet of paper; for the references in French are scored out, and letters blotted in—we cannot say written—to agree with the English description; and the reader is recommended in the specification to place the tracing which shows the improved block upon that which shows the old one, to enable him to judge of the difference in size, and consequent advantage: but which, of course, it is impossible to do as things are. Moreover, we would suggest to Captain Chamier the propriety of his not putting on record the filthy slang of the forecastle, seeing the English language is rich enough for him to describe technicalities with due regard to decency. His experience as an author (recently an historical one) ought to have enabled him to do this.]

WILLIAM EDWARD NEWTON, Chancery-lane, C. E. *For certain improvements in steam boilers.* (A communication.) Patent dated August 23, 1849.

These improvements consist in placing the furnace within or underneath the boiler, and fixing above it a conically-shaped heating chamber of copper, surrounded on the outside by the water in the boiler, the sides of which reflect the heat given off by the incandescent fuel on to it, and on to the combustible gases, which are thereby consumed. The non-combustible products escape up a flue placed on the top of the heating chamber, and surrounded with the water of the boiler, to the chimney. The steam is conducted by a pipe into an iron cylinder provided with a safety-valve, where it deposits whatever aqueous particles it may have brought over, and is then led to the steam cylinder. Both the boiler and cylinder are placed in a bath of sand, or other suitable material which is a bad conductor of heat.

*Claim.*—The combination with a vertical flue of a conical fireplace or enlarged heating chamber fixed to the bottom of the same, whereby the temperature is increased and concentrated by the heat evolved from the incandescent fuel being reflected on to the fuel and the combustible gases.

ALFRED VINCENT NEWTON, Chancery-lane, mechanical draughtsman. *For improvements in manufacturing and refining*

*sugar*. (A communication.) Patent dated August 23, 1849.

*Claims.*—1. The use of the bisulphites, or acid sulphites (particularly the bisulphite of lime), as preservatives against fermentation, and as depurators of vegetable juices containing saccharine matters.

2. The use of various antiseptic agents as preventives to fermentation in juices containing sugar.

3. The employment of baryta, strontia, the sulphurets of barium and strontium, of lime, or other metallic oxide, for precipitating and separating the crystallizable sugar, contained in fluids, in the form of insoluble saccharates.

4. A mode of forming saccharates of the above-mentioned substances.

5. The use of bisulphites and acid sulphites (particularly the bisulphite of lime), for the defecation of saccharine solutions.

Charles Cowper, Southampton-buildings, Middlesex. *For improvements in machinery for raising and lowering weights and persons in mines, and in the arrangement and construction of steam engines employed to put in motion such machinery; parts of which improvements are applicable to steam engines generally.* (A communication. Patent dated August 23, 1849.

The improved mine-lifting machinery described consists of four spears or rods, which are attached in pairs to the ends of a flat-link chain, one pair of which is employed to raise the carriages or boxes, and the other to lower them. The chain passes over a polygonal plate, which is made to revolve in opposite directions alternately, so as to communicate a reciprocating up-and-down motion to each pair of spears successively, by a steam engine or other suitable prime mover, the action of which is reversed as required. The lifting spears (supposing the stroke to be 50 feet) are fitted, at intervals of 46 feet, with catches, which have a tendency to project in a horizontal right line beyond the edge of the spears, but at the same time turn freely on axles to allow of their turning up out of the way when they encounter an obstacle in their descent. The up-shaft is fitted with vertical guides, between which the cross beam of each pair of spears slide—the pair being united at top by a cross beam which is made fast to the end of the chain,—and with other fixed guides which serve to steady the carriages or boxes in their ascent, and have catches affixed to them at intervals of 46 feet, similarly constructed to those before described. These catches turn up out of the way when the carriage comes between them, and allow it to ascend; but when it has cleared them, they return to their first position, and serve as stages to support the carriage. The down-shaft is similarly constructed and arranged, with the exception that the catches (their action being reversed) are fitted with weighted levers, and are only caused to come into position by the action of other levers and tappets thereon—their object being to convey the carriages down the stages successively. The action of the machine is as follows:—The lifting spears descend when the last two of the series of catch comes in contact with the carriage or box—one of the pair of spears being on each side of it—and turn up out of the way until they have passed beyond the bottom, when they naturally assume their first position, and on the action of the machine being reversed the spears move up and carry with them the carriage, resting upon the catches above the last pair of fixed catches or stages. On the reversal of the machine, the spears descend, leaving the carriage upon the fixed catch, and take hold of another carriage, while the second pair of catches on the spears support the first carriage in like manner; and on the ascent of the spears, the two are lifted up the shaft one stage. By this arrangement, each double stroke of the spears causes a carriage to be brought to the mouth of the shaft, just beneath which it strikes against a tappet, connected by a system of levers to the platform, covering the up-shaft, and thereby throws it over so as to close the down-shaft, where it is held by a catch until the carriage is moved out of the way, after which it returns to its former place on the ascent of the pair of spears of the down-shaft. For each carriage delivered at the mouth of the up-shaft, one is delivered at the bottom of the down-shaft.

The claims embrace the various arrangements, modes of construction, and combination, as described in the specification, and shown in the drawings which accompany it.

James Robinson, Huddersfield, York, orchil and cudbear manufacturer. *For improvements in manufacturing orchil and cudbear.* Patent dated August 30, 1849.

The patentee remarks, that it has hitherto been customary in the manufacture of orchil to mix the lichens with liquid ammonia to form a paste, which is turned over at intervals to expose it to the action of the air, whereby a considerable time and amount of labour is lost; and that his improvement in the manufacture of orchil consists in forcing the paste, prepared as heretofore, through the perforated bottom of a cylinder, by means of a plunger, into a receiver, whereby a greater amount of surface will be exposed to the atmosphere.

The improvement in the manufacture of

cudbear consists in drying it more rapidly than has yet been practicable, by forcing the paste through orifices on to a surface lightly.

*Claims.*—1. Causing the paste to pass through orifices or openings, whereby the surface is more largely exposed to the atmospheric air.

2 The mode of drying the paste when converting it into cudbear.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Andrew, of Compstall-bridge, Chester, manufacturer, and Richard Markland, of the same place, manager, for certain improvements in the method of, and in the machinery or apparatus for, preparing warps for weaving. February 21; six months.

James Hall, of Geecross, near Stockport, Chester, machine-maker, for certain improvements in looms for weaving. February 25; six months.

Brereton Todd, of the Bank of Falmouth, gentleman, for improvements in the manufacture of arsenic, sulphuric acid, and the oxide of antimony from copper and other ores in which they are contained, and also the oxide of zinc. February 27; six months.

George Gwynne, of Sussex-square, Middlesex, esquire, for improvements in the manufacture of sugar. February 27; six months.

Mathew Cochran, of High-street, Paisley, Renfrew, North Britain, manufacturer, for improvements in machinery for the production and ornamenting of fabrics and tissues generally, parts of which improvements are applicable to the regulation of other machinery and to purposes of a similar nature. February 27; six months.

Julius Jeffreys, of Bucklersbury, London, gentleman, for improvements in preventing or removing affections of the chest. February 28; six months.

George Tosco Peppe, of Great Marylebone-street, Middlesex, civil engineer, for improvements in time-keepers. February 28; six months.

George William Lenox, of Billiter-square, London, chain-cable manufacturer, and William Roberts, foreman to Messrs. Brown, Lenox, and Co., of Millwall, for improvements in working windlass and other barrels. February 28; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Feb. 21 | 2191 | John Broadfoot | Glasgow | Water-closet valves. |
| 22 | 2192 | William Simons | Greenock | Telescopic tiller. |
| ,, | 2193 | David Stephens Brown | Old Kent-road | Thermo-barometer. |
| ,, | 2194 | Thomas Warren | Oxford-street | Reading-stand. |
| ,, | 2195 | Joseph Wood | York | Razor. |
| 23 | 2196 | E. Moses and Son | Aldgate and Minories | Strap for trousers. |
| ,, | 2197 | William Hancock | Cross-street, Islington | Elastic safety-pocket or garde-poche. |
| 25 | 2198 | William Williams and Samuel L. Taylor | Bedford | Improved chaff-cutter. |
| ,, | 2199 | Luke Marshall Hill | Whitby | The "Habit Unique." |
| ,, | 2200 | David Stephens Brown | Old Kent-road | Hinged label. |
| ,, | 2201 | Biffen and Son | Hammersmith | Portable wager-boat. |
| ,, | 2202 | Alexander Symons and Alexis Soyer, carrying on business under the firm of A. Soyer and Co. | Charing-cross | Magic stove. |
| ,, | 2203 | Thomas Nixon | Kettering | Metallic ventilating skylight, or garden sash-frame. |
| 27 | 2204 | James Tyson Nibbs | Baslow, Chesterfield | The oxydate condensing lamp. |

## *NOTICES TO CORRESPONDENTS.*

*Mr. Bain's reply to Mr. Bakewell is unavoidably deferred till our next.*

*L. L. B. declined.*

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1387.] SATURDAY, MARCH 9, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

## DUJARDIN'S ELECTRO-MAGNETIC PRINTING TELEGRAPH.

Fig. 1.

## DUJARDIN'S ELECTRO-MAGNETIC PRINTING TELEGRAPH.

A printing telegraph, invented by Dr. Dujardin, of Lille, France, was tried with success on the Paris and Rouen line in 1846, about a year before Mr. Bain brought out his chemical printing telegraph. Dujardin's instruments are very little known in England: it is hoped that the following description, partly taken from a French work on telegraphs,* will be interesting to the readers of this Magazine.

The *sending machine*, or magneto-machine, used to generate the electric current, is shown in figs. 1 and 3: the same letters are used to distinguish the same portions of the apparatus in both figures.

A B C is a powerful permanent magnet, similar to those used on the Eastern Counties and other lines in England for ringing the bells: it is supported on three pillars, two of which, D, E, are seen in fig. 3, and is securely screwed to the stand by means of the brass rod H I and cross bar F G; L and M are coils of very fine covered copper wire, wound round the poles of the magnet. Two ends of the coils are joined together at U, and the other two ends are fixed under the terminals X, Y.

R S is an armature of soft iron placed in front of the poles of the magnet, so as just to clear them; this armature can be made to rotate by means of the driving-wheel PQ and the multiplying wheels N O; the driving-wheel (fig. 4) has on its circumference eight handles, at equal distances; and the multiplying wheels are so arranged that, for every complete revolution of the driving-wheel, the armature makes four complete revolutions. Therefore, by turning the driving-wheel *one-sixteenth* of a revolution, the armature will describe *one-quarter* of a revolution, or will be brought from the position SR (fig. 5) to the position S'R', and by turning the driving-wheel *one-sixteenth* more, or completing *one-eighth* of the revolution, the armature will be brought on again to the position SR, only the point S will be where the point R was before, and *vice-versâ*.

Fig. 2 shows the *receiving machine;* A is a hollow drum of metal from seven to nine inches in diameter, supported on brass uprights I, K; a slow rotary motion is given to the cylinder by means of the crank ONL, which is turned by clockwork P; at the same time a lateral motion is also given to the drum by means of the screw GH on its axle. The motion is, in fact, similar to that used by Mr. Bain in his large printing telegraphs.

BC is an electro-magnet fixed under the drum; it can be adjusted by means of the regulating screw D. The ends of the coil wires of the electro-magnet are screwed under the terminals X, Y. In front of the electro-magnet is the pen, which in fig. 2 is concealed by the drum, but a side view of it is shown on a larger scale in fig. 7. It consists of a bent piece of silver wire, PE, soldered to a piece of iron wire FE, mounted and balanced on a pivot E, from which hangs also a magnet H, by means of a piece of clock-spring EH. Fig. 6 shows the pivot EE', the clock-spring and magnet HH'. The end P of the pen is slightly flattened, and round it is wound a small piece of cotton wool, tied with a fine silk thread. The pen and cotton dip in a cup of ink I; on the drum A is stretched the paper on which the message is to be printed.

The receiving machine only requires *one* line telegraph wire to connect it to the sending machine; the electric circuit being made complete by earth plates. The connection and the earth plates are shown in figs. 1 and 2.

When a quarter of a turn is given to the armature RS, that is to say, when it is brought from the position RS to the position R'S' (fig. 5) an electric current is generated in the coils L, M, which current passes along the wire to the coils of the receiving machine B, C, and returns to the coils L, M through the earth. But in its passage, this current causes the electro-magnet BC to become a magnet, its *north pole* being opposite the *north pole* of the permanent magnet H (see fig. 7), and the *south pole* of the first opposite the *south pole* of the second. The magnet H is strongly *repelled*, and the pen is at the same time brought up out of the ink, and strikes against the paper on the drum AA', making a dot.

* Traité de Télégraphie Electrique, par l'Abbé Moigno; Franck, Rue Richelieu, Paris; Weale, Holborn, London.

Fig. 3.

Fig. 4.

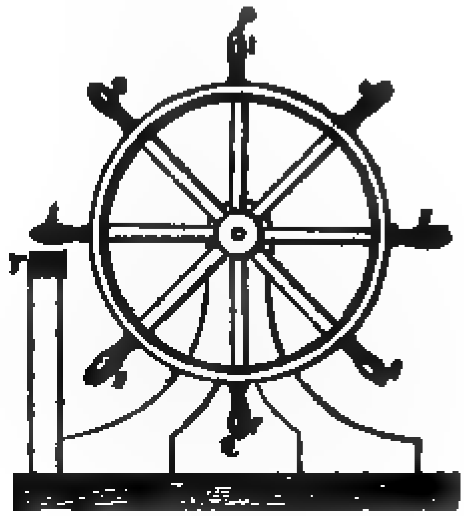


Fig. 5.

Fig. 6.

Fig. 8.

Fig. 9.

But by continuing to turn RS, it will from the position R′S′ come again to the position RS, that is, longways in front of the magnet ABC; an electric current is then again generated in the coils L, M, but in a direction reverse to the first: the *north pole* of the electro-magnet BC being now opposite the *south pole* of the magnet H, and the *south pole* of the first opposite the *north pole* of the second. The magnet H is *attracted* by the electro-magnet, and causes the pen to fall back into the ink, if it has not already done so by its own weight.*

By turning the driving wheel PQ one-eighth, we have seen that the armature RS describes half a revolution, and therefore produces the above two currents. Therefore by turning PQ one-eighth, or the distance from one spoke to the other, a dot is made on the paper: by turning it five spokes, five dots are made, and so on.

The drum having, as described, a lateral as well as rotary motion, the message is printed in a spiral on the paper; but if preferred, the message could be printed on a long slip of paper, as in Bain's Telegraph.

With the exception of the vowels, the letters are composed of two groups of dots separated by a short blank space, as will be seen below :—

*Dujardin's Alphabet.*

| | | | |
|---|---|---|---|
| E . | R . ... | H .. ..... | F .... |
| I .. | P . .... | L .... . | V .... .. |
| O ... | Q . ..... | M ... .. | X .... ... |
| A .... | N .. . | G ... ... | W .... .... |
| U ..... | D .. .. | J ... .... | Y ..... . |
| S . . | C .. ... | K ... ..... | Z ..... .. |
| T . .. | B .. .... | | |

On the left of the driving-wheel is placed a small cushion of Indian rubber T; this is of great use in working the machine; for example, suppose the sender wants to give the letter *R*, he places his left hand on spoke 2 (fig. 4), and his right hand on spoke 5; he then turns the wheel rapidly from right to left; but his left hand striking against the cushion, causes the wheel to stop for a space of time scarcely perceptible, but sufficient to produce the blank between the first dot and the last three.† But the sender takes off his left hand the instant it strikes the cushion, and continues to turn the wheel round with his right hand, till it is in its turn stopped by the cushion, after having produced the three dots.

Whilst the sender is placing his hands on the driving-wheel at the proper distances to make the next letter, the drum A has turned round sufficiently to leave the greater space required between the letter he has just printed, and the one he is about to send. A still greater space must be left between the words.

With a little practice great speed can be acquired in the working of the sending machine. A rate of about 90 words a minute can be easily obtained.

The bell used by Dr. Dujardin is different from that adopted in England. It consists of an electro-magnet AB, CD (figs. 8 and 9), the poles of which are seen at L and M; IK is a small flat magnet mounted on a pivot PO; FG is a drinking tumbler fixed by a screw F, to the stand, and HE a cylinder of box or other hard wood. This bell being put in circuit with the sending and receiving machines acts in this way; when the armature RS is brought to its first position R′S′, a current is sent through the electro-magnet AB, CD, so that the magnet IK is attracted by L and repelled by M, causing the end K to strike against the tumbler and producing a sound; when the armature is brought on to its position RS, a reverse current is produced, L repels and M attracts IK, and brings it back against HE; the pieces of soft iron ML, are fixed tightly on the cylinders of the electro-magnet by means of screws, but can, nevertheless, be turned round, so as to regulate their distance from the magnet IK.

Dujardin's telegraph has been tried in a circuit of 400 miles, and although it was raining hard at the time, marks were distinctly printed on the paper. It may be seen at work among Mr. Whishaw's collection, John-street, Adelphi.

THEODORE G. DE CHESNEL.

* This is not strictly correct: in practice the wheel is turned so fast that the current acts upon the pen, to make it fall quicker than it could if only acted upon by gravity.

† The drum A of the receiving machine of course continues to revolve during that time.

## SOLID HEADED BELL-SHAPED INSULATORS.

Sir,—I have this day seen No. 1378 of the *Mechanics' Magazine*, in which Mr. T. G. de Chesnel claims for Mr. Spowers, of the Electric Telegraph Company, the credit of inventing a solid headed bell-shaped insulator. The facts of the case are as follows:—In December, 1848, I showed an insulator to Mr. Spowers, as well as several other persons, amongst whom was Mr. Physick, the engineer of the Electric Telegraph Company, of which I send you a wooden model with the iron hook. The only difference between them is, that in Mr. Spowers' present one a notch is cut in the circle at the top of the shaft, and the lower part of the shaft cut circular for the hook to turn in (the last-mentioned alteration I used in one of mine, but considered it unnecessary), which I conceive is not an improvement on the original invention, as in making them in earthenware, the notch would be both difficult to make exactly at the proper angle, would be more expensive, and, at the same time, very liable to be warped in baking, by which the iron would be prevented from fitting when required to do so on the line. Another thing is that the notch is not required, as the pressure on each insulator on the Electric Telegraph Company's lines is quite sufficient to prevent the iron from turning in the earthenware, which I imagine is the *only intended* improvement in Mr. Spowers

*My invention*, precisely similar (in earthenware) to the model sent you, is, I am informed by Mr. W. Reed, used on the Electric Telegraph Company's wires. Trusting you will insert this. I am, Sir, yours, &c.,

WILLIAM H. BRIGHT.

9, Lawrence Pountney-lane, January 31st, 1850.

[We have to apologize for a delay in the appearance of this letter, which was accidentally mislaid.—ED. M. M.]

## THE PROBLEM OF ISSUING FLUIDS.—A NEW SOLUTION BY ALEXANDER Q. G. CRAUFURD, ESQ., M.A., OF JESUS COLLEGE, CAMBRIDGE.

Sir, — Fluid issues from a vessel through a small orifice in the bottom or side, no adjutage being employed, and the height of the fluid in the vessel being kept constant: it is required to calculate the discharge.

Poisson finds by theory the formula,

$\rho = at\sqrt{2gh}$, where

$\rho$ the discharge in the time $t$,

$a$ the area of the orifice,

$g$ the accelerative force of gravity,

$h$ the height of the upper surface of the fluid above the orifice.

He says that experience proves that his formula requires correction, and that it will be found conformable with experiment if we multiply the theoretical result by ·62; *i.e.* if we diminish it by more than one-third of its value. I propose the formula

$$\rho = \frac{nat\sqrt{gh}}{\sqrt{1+f\sigma}} \quad (1);$$

where $n$ and $f$ are coefficients to be determined by experiment, and

$$\sigma = \frac{\beta}{a},$$

$\beta$ being the perimeter of the orifice. In order to compare and test these two formulas, I employ the following six experiments of Bossut ("Traité d'Hydrodynamique," vol. ii., ch. 2).

| Constant height of the water above each orifice, 11 feet, 8 inches, 10 lines. | Number of cubic inches of water furnished in one minute. |
|---|---|
| By a circular orifice, 6 lines in diameter .. | 2311 |
| By a circular orifice, 1 inch in diameter .. | 9281 |
| By a circular orifice, 2 inches in diameter.. | 37203 |
| By a rectangular orifice, 1 inch by 3 lines.. | 2933 |
| By a square orifice, side 1 inch .......... | 11817 |
| By a square orifice, side 2 inches ........ | 47361 |

These are *French* feet, inches, and lines. The vessel employed was a rectangular parallelopiped, 12 feet high, and having for its base a square of which the side was 3 feet, and the orifices were horizontal. The application of our formulas requires that we know the value of $g$ at Mezières, where these experiments were made. I determined it thus:

Let $g'$ denote the force of gravity at Paris,
G „ the same force at the Pole,
$\lambda$ the latitude of Mezières $=49° \ 45' \ 43''$
$\lambda'$ that of Paris $=48° \ 50' \ 14''$.

Then, according to Poisson ("Traité de Mecanique," Nos. 115, 178),

$$g = \mathrm{G}\left(1 - \frac{\cos^2 \lambda}{200}\right), \quad g' = \mathrm{G}\left(1 - \frac{\cos^2 \lambda'}{200}\right),$$

and $g' = 9\cdot80896$ metres; the second being the unit of time. From these data I find $g = 9\cdot80974$ metres. We have also 1 metre $=3\cdot078444$ French feet, $=6$. And $\log 6 = 0\cdot48833132$.

By (1)

$$\frac{\rho}{at\sqrt{gh}} = \frac{n}{\sqrt{1 + f\sigma}}.$$

Let $m_1$ and $m_2$ be the values of this quantity given by the first and second experiments respectively, $\sigma_1$ and $\sigma_2$ the corresponding values of $\sigma$; then

$$m_1 = \frac{n}{\sqrt{1 + f\sigma_1}}, \quad m_2 = \frac{n}{\sqrt{1 + f\sigma_2}};$$

$$\therefore \text{Log } m_1 - \log n - \tfrac{1}{2}\log(1 + f\sigma_1), \ \log m_2 = \log n - \tfrac{1}{2}\log(1 + f\sigma_2) \ldots (2).$$

$$\therefore 2\log m_2 - 2\log m_1 = \log \frac{1 + f\sigma_1}{1 + f\sigma_2} \ldots (3).$$

By calculation I find

Log $m_1 = \bar{1}\cdot9386820$, $\therefore m_1 = \cdot868324$,
Log $m_2 = \bar{1}\cdot9404169$, $\therefore m_1 = \cdot871800$.

Substitute in (3), and you find

$$\frac{1 + 8f}{1 + 4f} = 1\cdot008021758,$$

$$\therefore f = \cdot002021657.$$

Now substitute in either of (2), and you will find

Log $n = \bar{1}\cdot9421658$, $\therefore n = \cdot875318$.

From these, calculate $\rho$ for the four last experiments, and you find,

In the third, $\rho = 37198\cdot8$
Observed value $= 37203$
Deficit $= 4\cdot2$

In the fourth, $\rho = 2936$
Observed value $= 2933$
Excess $= 3$

In the fifth, $\rho = 11817$
Observed value $= 11817$
Error $= 0$

In the sixth, $\rho = 47362\cdot8$
Observed value $= 47361$
Excess $= 1\cdot8$

Now let Poisson's formula be subjected to the same test. Write $\rho = mat\sqrt{gh}$. Then, by the first experiment you find, $\log m = \bar{1}\cdot9386820$. Calculating with this we find:

In the second, $\rho = 9244$
Observed value $= 9281$
Deficit $= 37$

In the third, $\rho = 36976$
Observed value $= 37203$
Deficit $= 227$

In the fourth, $\rho = 2942\cdot5$
Observed value $= 2933$
Excess $= 9\cdot5$

In the fifth, $\rho = 11770$
Observed value $= 11817$
Deficit $= 47$

In the sixth, $\rho = 47080$
Observed value $= 47361$
Deficit $= 281$

Hence I conclude that the formula which I propose is far preferable to that in common use, and that it gives the discharge with considerable accuracy, so

far as that quantity is dependent on the form and dimensions of the orifice, provided these elements are of the same order of magnitude as those employed in Bossut's experiments. Perhaps some of your readers may think it worth while to compare it with other experiments in which these elements are made to vary through a wider range. It is in the hope that this may be the case, that I solicit the insertion of this short paper in your Journal, which has so wide a circulation among practical mechanicians.

A. Q. G. C.

## ELECTRO-CHEMICAL COPYING TELEGRAPHS. MR. BAIN IN EXPLANATION.

Sir,—In reply to the specious and deceptive letter of Mr. Bakewell, in No. 1385 (p. 143), I crave insertion for the following explanation, deeply regretting that the limited space you can conveniently devote to this subject, prevents my going as fully into detail as would be necessary, for showing the number and varied character of Mr. Bakewell's misrepresentations.

Mr. Bakewell, at the outset, endeavours to get rid of my patent, of 1848, by describing it as limited to "copying types," although in my former communication I stated—and the statement is not contradicted—that in my specification it was expressly and most distinctly shown that *any surface* composed of conducting and non-conducting substances might be copied by my patent process.

Mr. Bakewell says (p. 143), "the *only resemblance* between *my* copying telegraph and Mr. Bain's of 1843, is, that in both a single marking point passes several times over different parts of the same line of letters." This sentence contains a sweeping assertion, and also an important admission. The falsehood of the assertion will be made apparent by a few simple interrogatories.

In the first place, I would ask, if synchronous movements in the distant corresponding instruments are not essential to the action of all copying telegraphs?

Secondly. Have I not described in my patent specification of 1843, the use of a clock at each station, in electric connection with my copying machine, for the purpose of insuring synchronous motion? Does not Mr. Bakewell use a clock in the same manner, and for precisely the same purpose? He does, and yet no resemblance!

Thirdly. The electric connections were effected by means of pendulums, in my patent copying telegraph of 1843, and are not the electric connections effected by means of pendulums in Mr. Bakewell's alleged invention? They are; consequently here is *another* point of *resemblance*.

Fourthly. In my copying telegraph, the electricity when transmitted by the pendulum of the clock produced magnetism in apparatus which regulated the motion of the machine. Does not precisely the same thing occur in Mr. Bakewell's arrangement? How then can there be "no resemblance."

Fifthly. My copying telegraph of 1843 consisted of a single wire (the earth forming half the circuit), at each station a clock, a telegraphic apparatus of *four wheels*, an electro-magnetic regulator brought into action by the pendulum of a clock, and a transmitting or receiving-apparatus actuated by the mechanism of *four wheels*. Mr. Bakewell's alleged invention comprises each and all of these elements—what then becomes of Mr. Bakewell's asserted "only resemblance?"

So much for the system of motive apparatus employed, throughout which the closest resemblance occurs; and now for the *modus operandi*. Does Mr. Bakewell produce his copy by printing, or by writing as with a pen? No, by neither: but by simultaneously tracing or ruling the subject to be copied, and also the surface to receive the copy. The electricity passing from the conducting portion of the subject to be copied to the ruling style, and from thence by the telegraph wire to the distant ruling style, which is ruling or tracing the receiving paper while the electricity passes—that is, whenever a conducting portion of the surface is passing under the style at the transmitting station. When no electricity passes—that is, when the insulating portion of the transmitting subject is under the ruling style of the transmitting instrument—the receiving paper at the distant station remains blank, producing a fac-simile of the subject transmitted, in the manner shown at page 102 of your 1383rd No. The

"resemblance" of the *modus operandi*, thus described, is admitted by Mr. Bakewell; but he says, "another feature of my invention is, the employment of a guide line on the transmitting instrument, by means of which the distant operator can tell to the thousandth part of a second whether there be a variation in the beat of the two pendulums, and is thus enabled to correct them." This means that the transmitting instrument interrupts the currents of electricity at certain periods of its revolution for a greater length of time than usual, which constitutes a means of knowing that the two instruments are going correctly together, or if not, to make them do so. My copying telegraph of 1843 did not require a guide line, because the pendulums were so constructed as to be self-correcting of any difference, however small, in every alternate vibration; but should any of your readers feel sufficient interest in the matter to visit the Enrolment-office and look at the specification of my patent of 1843, in sheet 5 of the accompanying drawings, they will there see the "guide line," which forms a most important feature in my letter-printing telegraph, and is the subject of a special claim, as that telegraph could not be worked without it. Was it from this source that Mr. Bakewell got "another feature of *his* invention."

Mr. Bakewell observes, "it will be seen by Mr. Bain's description and drawings of what he terms his 'Patent Copying Telegraph in its present improved state,' that scarcely anything of the original invention remains." To this I reply, that the alterations I have introduced do not alter the character of the invention; several of these arrangements were contemplated and pointed out in my original specification, and the invention is still substantially the same. The most important alteration is the substitution of a cylinder for a flat surface; but this is only an adaptation of part of a still older invention—my printing telegraph; and it was *cylinders* that I was actually using in the machines I was constructing and operating with at the time of Mr. Bakewell's visits!

Moreover, the apparatus described in my foreign patent (taken out before Mr. Bakewell's plan was made public), is precisely like that shown in your Number 1383!

Nothing can be more dishonorable than Mr. Bakewell's statement repecting my offer of 500*l.* if he accomplished his alleged improvements, or of his having made any disclosures to me. I certainly did say, that I would give Mr. Bakewell a sum of money if he accomplished certain things which he professed himself able to do, but which I knew to be *empty braggart*, and an impossibility. I also knew that Mr. Bakewell's stock of knowledge, electrical, chemical, and mechanical, was not equal to the production of anything of importance. So far from his making any disclosures to me, I knew nothing of his doings until I saw the abstract of his specification in your Magazine, which reached me at New York.

Mr. Bakewell unscrupulously charges me with having "stated and repeated again and again, that the difficulty of making two distant instruments to go together could not be overcome in any manner."

How could I possibly have made such a representation to him, when I had perfectly overcome this difficulty long before and included it in my patent of 1843?—namely, by means of stock pendulums, and also by the centrifugal governor and guide-wire. Moreover, I had successfully worked telegraphs upon this very principle at an interval of six miles apart, on the South Western Railway in 1844, before the Lords of the Admiralty and several hundred visitors.

Had I been in England at the time Mr. Bakewell applied for a patent, I should certainly have opposed his application with success, and I am sure it would have been doing him a service, by preventing his throwing away money in patenting what does not belong to him, and from which he can derive no profit.

Mr. Bakewell says an opposition was entered on my behalf and withdrawn, but by whom he cannot imagine. Having no knowledge of Mr. Bakewell's intentions, I had left no instructions to oppose his application, and I think Mr. Bakewell must be misinformed in this matter.

I remain, Sir, yours very truly,

ALEXANDER BAIN.

Hammersmith, February 28, 1850.

THE ELECTRIC-COPYING TELEGRAPH.

Sir,—I have carefully perused the communication of Mr. Bakewell (page 143) wherein he attempts to exculpate himself from the charges of piracy, deception, and breach of trust, brought against him by Mr. Bain in your 1383rd Number, and consider his defence most impotent. The similarity—nay, the identity of Mr. Bain's copying telegraph, to that so recently patented by Mr. Bakewell is admitted by Mr. Bakewell himself, and called "a direct infringement." Doubtless there is an infringement, but it must be on the part of Mr. Bakewell, because I have myself seen Mr. Bain operating with copying telegraphs in all respects identical with that described in No. 1383 of your Magazine, long before the date of Mr. Bakewell's patent!

I remain, Sir, yours respectfully,

WM. BADDELEY.

29, Alfred-street, Islington, February 27, 1850.

OPENING OF THE BRITANNIA TUBULAR BRIDGE.

(*From the Times.*)

Menai Straits, Tuesday afternoon, March 5.

The opening of this magnificent structure, looked forward to with so much interest, came off this day at dawn, with the grandest success. At half-past six o'clock A.M., three powerful engines (the Cambria, the St. David, and the Pegasus), of from 50 to 60-horses power each, decorated with flags of all nations and union-jacks, steamed up and harnessed together, started from the Bangor Station, carrying Mr. Stephenson, who drove the first engine through the tube, and the following gentlemen:—Mr. Bidder, engineer; Mr. Trevethick, locomotive manager of the London and North Western Railway; Mr. Edwin Clark, Mr. Latimer Clark, Mr. Appold, and Mr. Lee. At precisely seven o'clock, the adventurous convoy, progressing at a speed of seven miles an hour, were lost sight of in the recess of the vast iron corridor. Instead of being driven through with a despatch indicative of a desire on the part of those who manned it to get in and out with the utmost expedition, the locomotives were propelled at a slow and stately pace, with a view of boldly proving by means of a dead weight the calibre of the bridge at every hazard. The total weight of the locomotives was 90 tons. The appearance of the interior of the tube during the experiment was of a novel and remarkable character. The locomotives were brought to a standstill in the centre of each of the great spans, without causing the slightest strain or deflection. The first process—that of going through the tube and returning—occupied altogether 10 minutes. The second experimental convoy that went through consisted of 24 heavily-laden wagons, filled with huge blocks of Brymbo coal, in all, engines included, an aggregate weight of 300 tons. This was drawn deliberately through, at the rate of from eight to ten miles an hour, the steam working at quarter power. During the passage of this experimental train through the tube, a breathless silence prevailed, until the train rushed out exultingly, and with colours flying, on the other side of the tube, when loud acclamations arose, followed at intervals by the rattle of artillery down the straits. Upon the return, which occupied about seven minutes, similar demonstrations ensued, and during the progress of the train those who stood upon its top to ascertain any possible vibration, reported they could detect no sensible deflection. After this, Mr. Stephenson and his staff steamed up to Plas Llanfair, Mr. Foster's seat, and partook of a handsome repast. Meantime the locomotives were passing up and down the interior of the tube without eliciting the slightest manifestation of strain. An ordeal stronger still was then resorted to: a train of 200 tons of coals was allowed to rest, with all its weight, for two hours in the centre of the Carmarthenshire tube, and at the end of the time, on the load being removed, it was found to have caused a deflection of only four-tenths of an inch. It is remarkable that this amount of deflection is not so much as one half hour of sunshine would produce upon the structure, it being moreover calculated with confidence that the whole bridge might with safety, and without injury to itself, be deflected to the extent of 13 inches. These loads, it is most material to remember, are immensely more than the bridge will ever be called on to bear in the ordinary run of traffic, though the engineers are of opinion that it would support with ease, and without much show of deflection, a dead weight on its centre of 1,000 tons. Twelve miles an hour is the limit of speed at which Mr. Stephenson intends that trains shall at first go through, more particularly as there are sharp curves at the termini of the tube. * * * *

The effect of the recent hurricane on the calibre of the tube has proved that its lateral surface strength is sufficient, and far more than sufficient, to resist the strongest wind. It is calculated that, taking the force of the wind at 50 lbs. on the square foot—an excessive supposition—the resistance offered by the bridge would be 300 tons × 2 = 600 tons, which is not two-thirds of its own

weight. The wind going at 80 miles an hour, the rush of a hurricane would only press in the ratio of 128 tons on the side. It is intended, when both tubes are up, to brace them together with stays so as to counteract any possible oscillation.

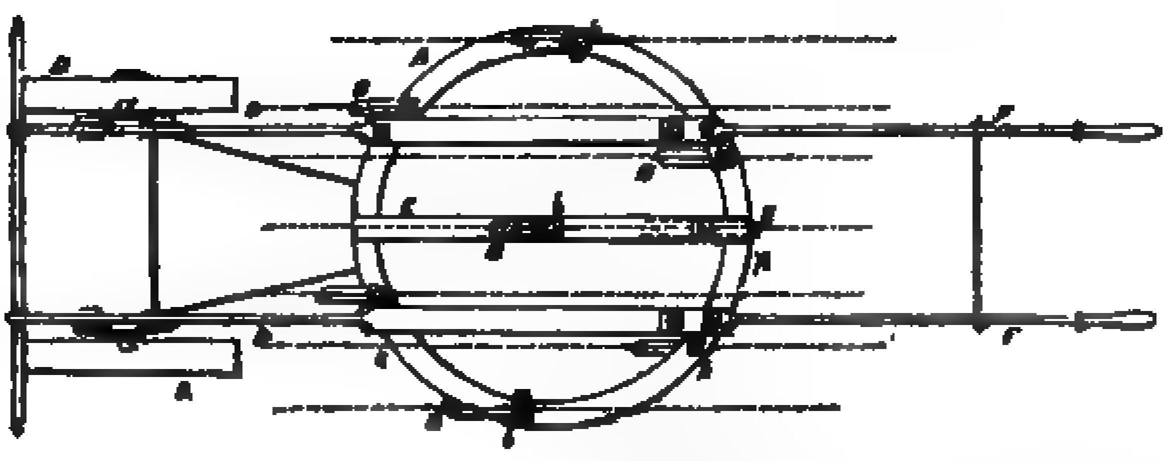
The great work has now been four years in hand, and is nearly complete, while Telford's suspension-bridge took eight years. The floating and actual transference of the tubes has occupied since June last—a short period when the bulk of the fabric is taken into consideration. Great fears were entertained for its safety during the late gales, from the recollection in this part of the country of the damage done to Telford's suspension-bridge.

## HARRIS'S ANNULAR CULTIVATOR.

(Registered under the Act for the Protection of Articles of Utility. Robert Harris of Braunston, Northamptonshire, Farmer, Proprietor.

Fig. 1.

Fig. 2.



*Description.*

Fig. 1 is a perspective view, and fig. 2 a top plan of this improved cultivator. A A, is a stout circular piece of metal; B B, are six shares or cutters, which are attached to the underside of the circular piece A, by means of their upper ends, *a a*, passing through the piece, and being fastened by nuts, *b b*, on the top side. C is a flat bar of metal which passes across the centre of the circular piece A, and has fixed to it a share, or cutter, B¹, similar to the ones before mentioned; D D, are the draught beams, and E E, are the handles; G G, are the guide wheels; H is an auxiliary wheel, for the purpose of using when it is desired to transport the cultivator from one place to another, being in such case securely attached to the bar C. By thus arranging the shares or cutters in a circular form, instead of placing them in a line with each other, as heretofore, a much better purchase and greater steadiness of action are ob-

tained. The shares can also be placed in a much closer order with respect to the cuttings as indicated by the dotted lines, although as far as the shares are relatively concerned, they are at a greater distance than in the old instruments, so that all that "blocking" or clogging, which is now common on heavy land, is completely obviated, and the instrument is much increased in strength and durability.

## ON THE CAUSES OF THE EXPLOSION OF STEAM BOILERS AND OF SOME NEWLY-DISCOVERED PROPERTIES OF HEAT. BY MR. JAMES FROST, OF BROOKLYN, NEW YORK.*

Lord Brougham, in his admirable discourse on the Objects, Pleasures, and Advantages of Science, observes, that "practical men are always in the way of good luck, by perceiving what is wanted or amiss in the old methods, and therefore they have a better chance than others of effecting improvements, and if they possess the requisite information, they can take advantage of it when it comes to them."

Having many years ago had particular "good luck" by narrowly avoiding the explosion of a steam boiler, by a singular and happy thought and different action to that commonly pursued and recommended, and as it may prove beneficial to others similarly situated, as well as instructive to the general reader, and as it was the commencement of the great discovery hereafter disclosed, I shall detail the occurrence :—

Whilst superintending the working of a high pressure and condensing engine of considerable power, I was suddenly alarmed by intelligence that the water was become deficient in the boilers. Now long before that period, by carefully observing the numerous accounts of disastrous explosions of steam boilers, I had formed an opinion, that on such occasions it was dangerous to suddenly open the safety-valves to discharge the steam, and which in this instance it was requisite to do, before the interrupted proper action of the feed-pump could be restored.

The first thing I did was to stop the engine; the second., to slightly increase the load on the safety valve; the third, to draw the fires and leave the cylindrical boilers buried in brick-work, to be cooled by the rapid current of air rushing past them up the chimney, for more than an hour. At the expiration of that period, as there was still considerable, though apparently weak, steam escaping, though almost noiselessly, from the safety valves, and which steam even then I dreaded to discharge; although at that time I could have given no very satisfactory reason for my apprehensions, I passed a rope over a pulley, and fastening one end of it to the lever of safety valve, I led the other end to a distant and strong building, and then pulling the rope, opened the safety valve thereby.

The steam which had appeared weak and escaping with scarcely any noise, suddenly rushed out with such a tremendous noise and volume as satisfied me at the time, that it had somehow suddenly acquired some new property and great power for mischief, so that I had no doubt, had the safety valve been opened somewhat sooner, the boilers, though of extraordinary strength, would have been blown to pieces.

The affair made so strong an impression on my mind, that I have never since failed to pay particular attention to every description of facts, which I have since seen recorded of explosions, anxiously endeavouring to account for them in a rational and satisfactory manner.

Having some time since had my attention again very strongly attracted to the details connected with the explosion of a large steam boiler, on which occasion also it was apparent, as it had frequently been before observed, that some immense explosive force had been suddenly generated and never before accounted for in a satisfactory manner, I set myself earnestly at work to investigate experimentally the causes of those terrible disasters, at once the opprobrium of engineers and a calamity to mankind, to discover, if possible, that long-suspected, but still unknown and undetected, sufficient cause therefor.

This important subject had already strongly attracted the attention of numerous engineers and of other persons in various countries, and, it is curious to see what insufficient and contradictory results they arrived at, all incompatible with many well-known facts that had been noted, particularly with two, which had been very often remarked.

First: It had been often remarked, that previous to an explosion the engine had laboured much and become insufficient for its usual duty, and which fact is perfectly at variance with the most commonly assumed position, that the explosions arise from over-increased tension of steam in boilers, for in that case the engines must have become more instead of less powerful.

Secondly: Explosions of boilers are of frequent occurrence, when it is morally certain that steam therein had just previously

* Republished from a pamphlet printed for the Author, New York, 1850.

been of greater tension, and at the instant of lowered tension, as when steam had become unduly high by the stoppage of the boat at a wharf for a short period, when an explosion seldom oı never occurs, nor till the engine has made "several strokes," or till the vessel has got to "some distance from the wharf," when the the explosion ensues, and of course under a diminished head of steam or reduced tension to what it had previously been.

Notwithstanding the inadequate result of numerous investigations long and earnestly prosecuted at great expense, it will seem passing strange they were all so unsuccessful, seeing so little was needed in prosecuting a most happy and singular conclusion which we have since arrived at by a certain, short, and easy path. It is truly wonderful to see how nearly many experimenters have approached, without at all reaching the object they were in search of.

Thus, for one instance of a tedious, expensive and perfectly abortive attempt, Perkins having conceived an idea, that "surcharged steam," as he termed it, might be produced in overheated boilers, become powerful and produce explosions. To test the same he constructed a cumbersome and expensive apparatus or generator, consisting of three tiers of cast-iron hollow blocks, set in a large mass of brickwork, the blocks being so connected together by slight wrought-iron tubes, that water might be forced into the two upper tiers, and, as he said, heated therein to between 700 and 800 degrees, and be forced from thence into the third tier, into which, as he stated and expected, "the heated water would flash into steam," and that steam becoming "surcharged with heat" in the lower tier, would be found to have acquired immense force from being surcharged with heat. Nevertheless, to his great surprise, and directly contrary to his anticipations, he found the steam to be very feeble, possessing but little of the tension he anticipated, for he had expected thus to have produced steam of exceeding great strength.

Now it is neither difficult to explain or to account for his great disappointment on this point. In the first place, he never could have confined water at the temperature of 750° in his cast-iron blocks, because at that temperature cast iron has little tenacity, and the tension of steam therein would have equalled a thousand atmospheres per inch, and his blocks could not have sustained a sixth part of that great internal pressure. Moreover, as the wrought-iron connecting tubes were little stronger than common gas tubes, it was idle to suppose they could sustain one-tenth the strain they would be subjected to. In the second place, he reckoned upon another impossibility; namely, that water heated to 750° would flash into steam, seeing that the latent heat in steam being about 1170°, the third tier of his blocks would furnish only the remaining requisite heat for the conversion of the water (were it already heated to 750°, which it could never have been) into common weak steam, which he found it to be.

Perkins then took another and as unfortunate a view of this subject. Still imagining his steam was surcharged with heat (which it could not have been), he conceived that it was deficient in tension, because being surcharged with heat, it was deficient of water; he, therefore, undertook to obtain pure steam of immense tension by injecting his "surcharged steam" through many small holes in a pipe, placed under water within a strong reservoir constructed for that purpose, wherein, he asserted his surcharged steam took up its equivalent of water, and became thereby immensely powerful and economical also; although by this clumsy roundabout process for forming common steam, it must be seen he neither did nor could derive any possible advantage, as was clearly shown on examination thereof in the truly scientific attempt to discover the real cause of the explosions of steam boilers, by the employment of rational means for that purpose, by a select committee of the Franklin Institute of Philadelphia.

For in 1835, this subject being considered of such great importance by the government of the United States, that at its request and expense it was long and ardently investigated by the select committee at Philadelphia, by which all the most plausible theories that had been previously promulgated by Perkins and others, were patiently and experimentally investigated, and all alike found to be unsubstantiated or contradicted by facts. After examining other matters connected with the subject and deserving investigation, the indefatigable committee arrived at the conclusion, that explosion of steam boilers occurred from the tension of steam becoming gradually superior to the strength of the boiler; and the prevention they mainly propose therefore was the use of double safety valves and of fusible metallic substitutes for valves, so chemically compounded, as to give way before great tension of steam could occur in the gradual manner they anticipated.

The extended mechanical and scientific proceedings of this committee, removing many errors, established many facts by valuable experiments and information, are ably set forth in consecutive Numbers of the *Franklin Journal*, commencing in January,

1836, terminating in June 1837; the latter portion being devoted to a valuable and useful investigation of the strength of the materials of steam boilers at various temperatures. To some of their investigations we shall hereafter profitably revert. That many explosions have occurred solely from the tension of the steam becoming greater than the boiler could sustain, and will again occur from the same cause, more certainly as boilers become older and weaker, was too obvious to have required a scientific investigation; but as all such explosions must have occurred when the steam had acquired its greatest strength, it is apparent some other more occult cause must exist, because many of the most frequent and dreadful explosions have happened, when it was morally certain the steam had considerably less tension than the boilers had just previously sustained. Moreover, just as violent and destructive explosions have taken place in low-pressure boilers, in which the steam at any time could have had but little tension. Notwithstanding this, both high and low-pressure boilers have occasionally exploded by a suddenly-generated force, that could be likened only to that derived from the instantaneous explosion of gunpowder.

Still at later periods the world has been bewildered with attempts, vainly and inadequately, to explain the mysterious cause of explosions. Nothing can be more injurious to science than the adoption of whimsical and inadequate theories; and it must be remarked, that none have been more whimsical, or unfounded, or pertinaciously persisted in, than those of the learned author of seven editions of a treatise on the steam engine, and in which treatise another, a greater, a more ridiculous and more mischievous error, still remains to be exposed on the fitting opportunity.

Because the explosion of a locomotive steam boiler and a tempest occurred on the same day in Pennsylvania, Doctor Lardner attempted to prove, in his learned manner, that the explosion of steam boilers was occasioned by lightning!

Unfortunately for the doctor's profound knowledge of steam, it subsequently appeared, the tempest had ceased for some hours before the explosion occurred; and still more unfortunate for his electrical knowledge, no situation can be conceived more free, or so free, from the effects of lightning than the interior of the metallic boiler of a locomotive in metallic connection with a railroad.

The curious fact, and the cause thereof, will soon become apparent, however singular it may now appear, that under particular circumstances, by no means unfrequent, the sudden abstraction of a volume of steam from a boiler may become the inciting cause of the explosion of that boiler, however strong. How needful, then, must be a knowledge of this hitherto unsuspected cause of such disasters, even were this knowledge unaccompanied by any other advantage, and more especially because in this particular case the very means that have been prescribed by the best authorities as the means of prevention, become the sure means of destruction.

As we stated at the commencement, we were not satisfied with any explanation that had then appeared, we endeavoured, and have happily succeeded, in discovering both an ample and hitherto unsuspected cause for the explosions of steam boilers. This discovery will be found valuable beyond calculation, and far beyond any of our previous expectations; for we have also discovered that explosions are not only occasioned by the sudden production of an unknown elastic fluid,—a far more voluminous and energetic fluid than steam, which, however wonderful it may appear, may occasionally and suddenly be produced from the same quantity or equivalents of caloric and water; and what renders this discovery immensely valuable is the fact, that this new and superior elastic fluid, hitherto unknown to and unsuspected by chemists, may be far more easily and economically generated than steam, and employed with as perfect safety as steam, by a new, less expensive, and far less cumbersome apparatus; hence it will be vastly more economical than steam, because motive force may be far more easily, cheaply, and safely obtained thereby, thus exhibiting a distinct and new elementary compound, a far more voluminous and less expensive combination of fire and water, though of equal tension and mercantile value, which, therefore, must become immensely more serviceable to mankind.

At the same time this discovery exposes one of the grossest mistakes and unfounded and astounding errors imaginable, first originated by those eminent chemical writers, Dr. Dalton and Gay Lussac, since continually copied by others and by all writers on the steam engine who advert to that particular subject, all of whom, with one exception, state, that when steam is heated out of contact with water, it is expanded at the same rate as atmospheric air, or the gases, namely $\frac{1}{480}$ part in volume by every additional degree of heat, or that its volume is doubled by 480 degrees of heat, while one learned exceptionist states, that, by a more rigid and accurate experiment, a volume of steam, when so heated, is doubled by 460 degrees only!

Now our experiments have disclosed and our diagrams represent (all of which can be easily repeated and verified at little trouble and expense), that a volume of steam heated out of contact with water is doubled by the addition of about four degrees of heat, trebled by about sixteen degrees, and increased near tenfold by 440 degrees. Can any parallel be found for such an extreme absurdity as is here exhibited, between the mischievous theories that have been so long and pertinaciously propounded by many and most learned writers, and the plain facts we are about to disclose and substantiate by experiments and describe by sundry diagrams, all alike being delineated from a scale of one half the dimensions from that by which the original instruments were constructed, and which instruments are thus faithfully represented on this diminished scale.

(*To be continued.*)

### GRANULATING LEAD.

Sir,—In your valuable Magazine for December, 1849, page 522, I find an inquiry as to the best mode of granulating lead, by "I. F. E.," dated Swansea. Your correspondent will find the following plan answer:—A slow fire under a large iron pot, say three feet in diameter, will keep the lead in a low state of fusion. Stir it constantly with an iron rod, clearing the sides of the pot from the lead which adheres to it; then dip a large ladle in about every ten minutes, perforated with small holes. The lead, in a granular state, remains in the ladle, and the melted metal runs through the holes into the pot again. Two or three smart agitations of the ladle will facilitate the escape of the fluid lead.

I am, Sir, yours, &c.,

WILSE BROWN.

Egglestone, Barnard Castle,
Jan. 26, 1850.

### SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 7TH, 1850.

THOMAS SYMES PRIDEAUX, Southampton, gentleman. *For improvements in puddling and other furnaces, and in steam boilers.* Patent dated August 30, 1849.

The patentee, who disclaims the latter portion of his title, "and in steam boilers," states that his invention refers firstly to puddling and mill, or scrap furnaces; and, secondly, to smelting furnaces.

1. The puddling furnace is constructed, as usual, with the exception that the bottom of the puddling chamber is made hollow, into which air is forced through a pipe, by means of a fan, or other suitable blowing machine, whence it exudes through the two (furnace and chamber) bridges, which are made hollow for that purpose, into passages in the side of the chamber, which conduct it into the closed ash-pit of the furnace. Or, the air may be forced in like manner, after being heated, into the lower part of the furnace—the openings being fitted with bars to prevent their being choked by clinkers. Openings are made in the sides of the furnace which communicate with the air passages to admit of the entry of a suitable tool for cleansing them when required. These openings are provided with covers to prevent the escape of air from the air passages when the furnace is working.

2. The smelting furnace is constructed with a fire-place, to which hot air is applied as before, and behind which is the crucible provided with tapping holes, as usual. Next to the crucible is the smelting portion of the furnace, on to which the ore and flux are dropped, through a hopper in the crown, and, when melted, they run into the crucible. The slag and metal are then drawn off by their respective tapping holes. The ore and flux are partially heated, before they are supplied to the furnace, by being contained in a passage constructed in a part of the chimney which is inclined for that purpose.

*Claims.*—(In respect to puddling, and mill or scrap furnaces):

1. The combination of a closed ash-pit with air passages, and hollow bottom to the puddling chamber, and the application of air under pressure previously heated.
2. The use of bars, as described.
3. The arrangements for cleaning the air passages.
4. The mode of constructing smelting furnaces.

CHARLES MOREY, Manchester. *For certain improvements in machinery or apparatus for sewing, embroidering, and uniting or ornamenting by stitches various descriptions of textile fabrics.* Patent dated August 30, 1849.

The patentee describes and claims:—

1. A basting machine. A pair of wheels are fitted with leaves on their peripheries, and gear into one another like cog-wheels. These wheels are mounted in suitable bearings, fixed to a sole plate, and receive rotary motion by means of a winch handle. The centres of the leaves of both wheels are cut away, so as to form a circular groove between the two leaves which happen to be together. Opposite to this groove, and at the other end of the bed-plate, there is a standard which car-

ries a cross-piece, having a slot cut on its top surface, in which the eye-end of the needle rests, while the point is supported in the groove. The thread is passed through the eye of the needle, and the fabric to be stitched placed between the wheels, to which rotary motion is communicated, whereby the fabric is successively folded into undulations which, as the operation proceeds, are forced on to the point of the needle. When the needle is full, it is taken out and drawn through the fabric, carrying the thread with it.

2. A modification of the preceding machine, which is stated to be more applicable to fine work; such, for instance, as umbrella seams. The lower wheel is replaced by a rack having a longitudinal groove on which the needle is supported. The revolution of the wheel pushes the rack from one end to the other, and forces the work over the point of the needle, which is, of course, much finer than that used for basting, and is drawn, having the thread passed through the eye, through the fabric.

3. A tambour stitching machine, which consists of a framework carrying a main shaft, that communicates, by means of different systems of cams and levers, the various necessary motions to the needle-holder, to the hooked instrument for holding the loop, to the bars which carry the work gradually between the needle and hooked instrument, and to an apparatus for regulating the quantity of thread supplied to the eye of the needle. The *modus operandi* is as follows:—The thread is attached at one end to the fabric, and the needle, which is supported in the end of an arm pendant from the extremity of a rod, to which a horizontal to-and-fro motion is communicated by means of a cam on the main shaft, is caused to advance, pierce the fabric, and carry the thread through to the other side when the hooked instrument is moved forward, and enters the loop. The continued revolution of the shaft causes the needle to recede, and the fabric to be carried a certain distance onward. The needle then again pierces the fabric, and enters the loop, which is left open by the inclination of the hook, which retires to its first position, liberates the loop, and takes hold of a fresh one. The patentee describes a modification of the preceding machine, which relates principally to the shape of the hooked instrument.

4. An apparatus for stitching fabrics together, which consists of a circular plate fixed on the top of a standard, and carrying an eccentric ring, the outer periphery of which is fitted with teeth to support the fabric. The top of the ring is furnished with teeth into which takes a click on the end of a lever made to vibrate by the main shaft, whereby an intermittent rotary motion is communicated to the ring. The plate is fitted with a circular shuttle race, an opening being made in the front part of it, into which the needle is made to take in and out alternately by the oscillations of the needle-holder, which is also actuated from the main shaft. As the needle retires from the fabric, it leaves a loop of the thread behind, through which the shuttle is thrown. The needle, still retiring, draws the stitch tight, in consequence of the thread being pressed against the holder by a spring which comes into action as it recedes. The shuttle-box is driven by the revolution of two spring arms, which are furnished with studs at their extremities which take into slots in the shuttle-box, and are successively lifted out as they come opposite the loop by raised projections in the race.

5. A modification of the preceding arrangement is lastly described, in which a reciprocating, instead of a rotary motion, is given to the shuttle.

Onesephore Pecqueur, C. E., Rue Neuve, Popincourt, Paris. *For improvements in the manufacture of fishing and other net-work.* Patent dated August 30, 1849.

*Claims.*—1. The manufacture of fishing and other nets by the movement of a hook-box constructed and arranged as described.

2. The manufacture of fishing and other nets by means of a shuttle constructed and arranged for working as described.

3. The manufacture of fishing and other nets by means of hooks or a comb constructed, combined, and adapted as described.

4. The manufacture of fishing and other nets by means of an arrangement and apparatus for producing the selvages as described.

5. The manufacture of fishing and other nets by means of an apparatus for drawing close the knots constructed and arranged as described.

6. The manufacture of fishing and other nets by means of certain arrangements whereby the several motions are transmitted as described.

Sir John Macneil, Knight, Dublin, and Thomas Barry, Lyons, near Dublin, mechanic. *For improvements in locomotive engines, and in the construction of railways.* Patent dated September 6, 1849.

These improvements embrace,

1. A mode of constructing and working the slide valves of locomotive steam engines by means of two eccentrics, instead of four, as has hitherto been usual. And

2. A mode of constructing iron sleepers, which are united by flexible (malleable iron) cross bars, and rest upon cast iron plates bolted to rigid cross bars. The under faces of the sleepers and the top surfaces of the cast iron plates are furnished with grooves and feathers, to keep the rail to the required gauge.

*Claims.*—1. The construction and mode of working the slide valves of locomotive steam engines by two eccentrics instead of four.

2. The construction of iron sleepers combined with flexible cross bars, which possess the advantages of longitudinal and cross sleepers, and prevent oscillation of the engine by allowing the rail to assume the inclination adapted to the tread of the wheel.

MALCOLM MACFARLANE, Thistle-street, Glasgow, coppersmith. *For certain improvements in machinery or apparatus for the drying and finishing of woven fabrics.* Patent dated August 30, 1849.

The patentee describes and claims a peculiar construction and combination of breadthening or stretching cylinders, and of angling cylinders, in one machine, whereby the fabric is subjected to the action of one of the cylinders in each series alternately.

The breadthening cylinders, which are heated interiorly by steam, or hot vapour, and are fitted with wire cloth to hold the fabric, are suspended in the upper part of a suitable framework, and receive rotary motion from any prime mover. The arrangement for widening them is much the same as has hitherto been used. The angling cylinders are supported beneath the breadthening ones, and are made to revolve also. The traverse bars are provided at parts with wire cloth to hold the fabric, and are supported loosely in slots in the cylinder, any convenient number being adapted to each cylinder. The ends of the bars are furnished with a pair of rollers each, between which takes a disc, two-thirds of the periphery whereof is undulating, so that, on motion being communicated to the different parts of the machine, the fabric will pass over the first breadthening cylinder, and then under the first angling cylinder, when the undulation of the disc coming into effect will angle the fabric for two-thirds of its rotation; and at the last third, the undulations having passed, the fabric will pass smoothly, and be delivered to the second breadthening cylinder, as even as when received. The selvages of the fabric are pressed against the edges of each cylinder by an endless band, which retains it in position.

ISIDORE BERTRAND. *For an improvement for protecting persons and property from accidents in carriages.* Patent dated August 30, 1849.

This invention consists of certain mechanical arrangements adapted to the axletrees of carriage wheels, by which the wheels and horses can be stopped at will, and accidents from horses running away be thereby entirely prevented.

*Claim.*—The mechanical arrangement for stopping wheels of vehicles and horses, or the horses thereof, by a break set on the axletrees.

ALEXANDER ROBERT TERRY, Manchester-street, Manchester. *For improvements in the manufacture or preparation of firewood.* Patent dated September 6, 1849.

The blocks of wood are first cut to the requisite length, and fed into a number of hoppers placed on either side of a crosshead, which carries the longitudinal cutters, and is connected to a crank shaft driven from the main shaft by toothed gearing, whereby the cutters are caused to move up and down. Upon the bed plate of the machine, above the driving gear, are a number of carriages equal to that of the hoppers, which are connected to the crank shaft in such manner that they are caused to pass under the hoppers, liberate one of the blocks in each, carry the liberated block under the appropriate set of cutters, and hold it securely while subjected to their action; then carry the split block beyond the mouth of the hopper, and drop it down a receiver, which conveys it to a pair of rollers that compress and pass it to a hollow plate, whereby it is held by about the middle until tied up. In order to obtain the cross cut, slots are made in the longitudinal cutters in which the cross cutters are supported.

*Claims.*—1. The combination of parts into a machine, as described.

2. The arrangement of the cutters for splitting the blocks of wood in two directions.

3. The use of the pair of rollers and plate for holding split blocks while tied.

JOSIAH MARSHALL HEATH, Hanwell, Middlesex, gentleman. *For improvements in the manufacture of steel.* Patent dated September 6, 1849.

The improvements embraced under this patent consist in subjecting iron, in a granular state, obtained by the cementation or deoxidizing of ores (by preference magnetic ores) to a welding heat, in combination with manganese and carbon. The iron is afterwards made into bloom, then into bars or slabs, which are subsequently converted in the usual way. The proportions given by the patentee are, 1 to 3 lbs. of oxide or chloride of manganese, and 1 to 2 gallons of coal tar, or other hydrocarbon, to every 100 lbs. of iron.

*Claim.*—Subjecting iron, in a granular state, to a welding heat, when combined with manganese and carbon: which iron is afterwards to be made into bars or slabs, or other suitable form, and converted.

John Hosking, Newcastle-upon-Tyne, engineer. *For an improved pavement.* Patent dated September 6, 1849.

The patentee describes and claims:—

The constructing a pavement of blocks of wood, either alone, or combined with tiles or blocks of any other suitable substance, which are perforated with longitudinal and transverse holes for the purpose of drainage. The blocks of wood, or portions of them, are made with teeth, which project above the general surface of the pavement, so as to form a number of interstices, which are filled with broken stones, asphaltum, or other substance employed for pavement, in such manner as to form the bearing surface of the road.

The patentee states that a pavement constructed according to his invention will last much longer than ordinary ones, inasmuch as the wooden teeth will prevent the grinding action of the stones under pressure; and that it also causes less noise than the ordinary stone pavement.

Alexander Haig, Smith-street, Stepney, engineer. *For improved apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery.* Patent dated September 6, 1849.

*Claim.*—A peculiar combination of a fan and two cylinders which constitutes an apparatus for exhausting and driving atmospheric air and other gases, and for giving motion to other machinery.

## RECENT AMERICAN PATENTS.

(Selected from the Report of Mr. Keller, in the *Franklin Journal.*)

For a Self-regulating Filtering Diaphragm. *William H. Jennison.*

The nature of this invention consists,

1. In making a filtering diaphragm to turn on a journal, and provided with a key or handle, by which it can be turned, when this is combined with, and so arranged within, an outer shell or case of a spheroidal form, or otherwise so formed as to admit of a free passage of the water or other fluid when the diaphragm is turned longitudinally, but which will have to pass through the filtering medium when the diaphragm is placed transversely, by means of which combination and arrangement either filtered or unfiltered water may be drawn, and by means of which, also, the filtering medium can be reversed within the outer case for the purpose of cleaning.

2. In making the filtering diaphragm of one or two moveable perforated plates, held within a casing which admits of their being moved towards one another to a certain and definite extent, when this is combined with an interposed filtering medium, composed wholly or partly of sponge or other elastic medium.

3. A mode of packing the outer periphery of the filtering diaphragm, and consists in making two grooves in the said periphery, one on each side of the axis of rotation, and fitting to each groove an annulus of vulcanized Indian rubber.

And the last part of my invention relates to the packing of the journal which passes through the outer shell or casing, or for other packing, and consists in filling a metallic case with the appropriate compound of Indian rubber, while the said compound is in a soft and semi-fluid state, leaving a hole in the centre, such as will admit of inserting the journal or other article to be packed, and then baking the said rubber after the usual or any other mode of treating what is called vulcanized rubber; after being properly baked, the metal case is soldered or otherwise secured to the outer shell or casing of the filter.

*Claims.*—1. The combination of a filtering diaphragm composed of elastic media and moveable discs, substantially as described, when combined with an outer shell or case within which it can rotate, either to force the liquid to pass through the filtering medium, or to pass by the side thereof, and issue without being filtered, the stem or journal of the diaphragm being passed through a stuffing-box attached to the outer case, as described, or in any other manner essentially the same.

2. Making the filtering medium with one or both perforated discs, moveable, as described, when combined with an elastic filtering medium, substantially as described.

For an Improvement in Electric Telegraphs. *Samuel F. B. Morse.*

The patentee says,—"The nature of my invention consists, 1st, in the application of the decomposing effects of electricity, produced from any known generator of electricity, to the marking of the signs for numerals, or letters, or words, or sentences, invented and arranged by me, and secured by patent bearing date June 20th, 1840, reissued January 15th, 1846, and again reissued June 13th, 1848, or their equivalents, through a single circuit of electrical conductors. 2nd. In the mode of applying this decomposition, and the machinery for that purpose. 3rd. In the application of the bleaching qualities of electricity to the printing of any desired characters."

*Claim.*—"What I claim as of my own invention and improvement, is, 1st, the use of a single circuit of conductors for the marking of my telegraphic signs, already patented, for numerals, letters, words, or sentences, by means of the decomposing, colouring, or bleaching effects of electricity, acting upon any known salts that leave a mark as the result of the said decomposition, upon paper, cloth, metals, or other convenient and known markable material.

"2nd. I also claim the combination of machinery as described, by which any two metallic points, or other known conducting substance, broken parts of an electric or galvanic circuit, having the chemically prepared material in contact with and between them, may be used for the purpose of marking my telegraphic characters, already patented in letters patent, dated 20th of June, 1840, in the first re-issue, 15th of January, 1846, and second re-issue, 13th of June, 1848."

For an Improvement in Broom Brushes. *Agdalena S. Goodman.*

*Claim.*—The application and adaptation of the branches of the cabbage-palmetto tree to the manufacture of brooms and brushes (the handles being a portion of the same).

For an Improvement in Brewing and Preserving Alcoholic Drinks. *John Hopkins.*

*Claim.*—The preparation and employment of oak, or other woods possessing similar chemical properties, or an extract of such woods, as described, as a substitute for hops, in brewing, distilling, and yeast-making, to refine and improve the flavour of spirituous liquors, as a counteractive of acetous fermentation generally in wines and other fermented liquors, in syrups, in vegetable extracts, and other unfermented liquids, and to correct and improve the flavour of stale wines, cider, or beer.

For an Improvement in Destroying Weevil in Grain. *William Watson.*

*Claim.*—The application of the combined action of heat and concussion to grain and other seeds, for the destruction of weevil and other insects, and the eggs and larvæ thereof infesting the same, and separating other foreign matter therefrom, by means of a hollow prism, heated from its interior and turning in a trough, the prism being surrounded by adjustable cells attached obliquely across its sides.

For an Improvement in Preparing Metallic Patterns for Castings. *Theodore G. Bucklin.*

The patentee says,—This invention consists in converting the surface of iron castings into plumbago, by treating them with dilute acid, which dissolves out most of the iron, but leaves the carbon, which is insoluble in the menstruum, in the form of graphite or plumbago, which, when dry, is capable of being smoothed and polished, so as to make it suitable for the surface of patterns, and for the protection of the interior iron from oxidation.

*Claim.*—Converting the surface of iron castings into plumbago, by treating them with dilute acid, and then reducing them to the required form and size, and smoothing and polishing them.

For an Improvement in Packing of Rotary Pumps. *Albigence W. Cary.*

The patentee says,—1st. The nature of my invention consists in providing a perforated partition or wing between the supply and exhaust tubes and the chamber in which the pistons revolve, to act as a strainer, to prevent sand and other impurities getting into the chamber.

2nd. In providing the perforated partition with a metallic butt, having its interior end packed with spring or other packing, so as to have it fit snug or lie in close contact with the revolving drum, and effectually secure a separation between the induction and eduction openings.

3rd. In providing sliding pistons or valves which slide in slots in the drum, and in providing said pistons with packing on the outer ends, and also on the upper and under or sliding surfaces; and also in providing the said pistons with small side orifices communicating with interior orifices, to allow a small amount of steam, &c., to get under the packing when the engine is in operation, to expand gently the packing, and make the pistons move in the chamber in close contact with all parts of the cylinder. In connection with this part of my invention, I provide spring bolts fitted into openings in the back part of the pistons, and having the heads of said bolts press against the periphery of an interior cam, so as to press out the pistons against the interior rim of the cylinder, so as to have the ends of the piston always in close contact with the said part of the cylinder.

4th. In the employment of circular grooves in the plates of the cylinder or chamber, for the drum to move in.

5th. A small groove is provided on each side in the slots of the drum in which the pistons slide, and fitted with any packing substance most suitable, to prevent the steam, water, &c., getting into the interior of the drum from the chamber, and also for the purpose of lessening the friction of the pistons when moving in the said slots of the moveable drum.

*Claim.*—The pistons, packed as described

and with small orifices in the pistons, to allow steam, water, &c., to be admitted, as described, under or inside of the packing when the engine is in operation.

FOR AN IMPROVEMENT IN IMITATIONS OF MARBLE. *Samuel W. Davis.*

*Claims.*—1st. The employment of strong acid in the preparation and application of colours for producing appearances of marble on woods and minerals.

2nd. The application of lime and nitre as receiving mordants, adapted to minerals and wood where veins or variations are to be produced imitating marble.

3rd. The use of mucilaginous pastes, composed of corn meal, slippery elm bark, or rice water, applied to canvas, paper, gum elastic, &c.

4th. A process of preparing and of transferring the colours from a temporary to a permanent ground.

5th. The composition of glass, lime, shellac, nitro-muriate of zinc or aqua regia, and alcohol, as a compound hard polish for marbling wood and porous mineral surfaces.

FOR AN IMPROVEMENT IN BENCH PLANES. *Charles S. Beardsley* and *Simeon Wood.*

The patentees say,—The nature of the first part of our invention consists in making the surface of the plane, from the cutting edge back, on a level with the cutting edge, and the surface forward of the cutting edge parallel with the rear part, but movable and adjustable, that it may be set so much above the level of the rear part as to determine the thickness of the shaving to be cut, and constitute a gauge for this purpose, and thus permit the entire surface of the plane back of the cutting edge to rest and run on the planed surface, whilst the forward part or gauge runs on the part from which the shaving has not been cut.

And our invention also consists in making one surface of the planing bit or cutter the rear part of the surface of the plane, when this is combined with the making of the rear part of the stock, from the throat of the plane to the back, hollow for the passage and discharge of the shavings.

*Claim.*—Constructing and applying the bit or cutter substantially as described, that its lower surface may constitute that part of the surface of the plane back of the cutting edge, in combination with the hollow stock for the passage and delivery of shavings, substantially as described.

FOR IMPROVEMENTS IN COTTON GINS. *William Y. Layton.*

*Claim.*—1st. The combination of adjustable bearings or boxes and screws with the rollers and hinged caps, for supporting, holding, and adjusting the rollers at the several points between their ends, where said bearings are applied and are liable to wear, arranged and operating substantially in the manner and for the purpose set forth, by which the operator is enabled to retain a parallelism of revolving surfaces, however unevenly the bearings may wear; the rollers being made to coincide by separate and independent screws and tops, or wedges, or in any way by which the same object may be attained, and by which the rollers shall be made to produce equal pressure on the cotton wool as it passes between them.

2nd. The combination of the hinged caps with the hinged plate forming the upper end bearings, and the brush block and brushes arranged and operating in such manner as to admit of their being raised from the rolls.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Richards, William Taylor, and James Wylde the younger, of Falcon Works, Walworth, Surrey, cotton manufacturers, for improved rollers to be used in the manufacture of silk, cotton, woollen, and other fabrics. March 2; six months.

William Edwards Staite, of Throgmorton-street, London, gentleman, for improvements in pipes for smoking, and in apparatus connected therewith. March 4; six months.

William McNaught, of Rochdale, Lancaster, engineer, for certain improvements in steam engines, and also improvements in apparatus for ascertaining and registering the power of the same. March 7; six months.

John Fowler, Jun., of Melksham, Wilts, engineer, for improvements in draining land. March 7; six months.

William Benson Stones, of Golden-square, Middlesex, Manchester warehouseman, for improvements in treating peat and other carbonaceous and ligueous matters, so as to obtain products therefrom. (Being a communication.) March 7; six months.

William Brown, of Airdrie, Lancashire, electrician, and William Williams the younger, of St. Dennis, Cornwall, gentleman, for improvements in electric and magnetic apparatus for indicating and communicating intelligence. March 7; six months.

Henry James Towling, of Bayswater, Middlesex, commission agent, for improvements in the manufacture of fuel and manure, and deodorizing and disinfecting materials. March 7; six months.

William Church, of Birmingham, engineer, for certain improvements in machinery or apparatus to be employed in manufacturing cards and other articles composed wholly or in part of paper or pasteboard, part or parts of the said machinery being applicable to printing the same, and parts to other purposes where pressure is required. March 7; six months.

Richard Archibald Brooman, of the firm of Messrs. J. C. Robertson and Co., of Fleet-street, patent agents, for improvements in types, stereotype plates, and other figured surfaces for printing from. (Being a communication.) March 7; six months.

Richard Carte, of Southampton-street, Strand, Middlesex, professor of music, for certain improvements in the musical instruments designated flutes, clarionets, hautboys, and bassoons. March 7; six months.

John Tayler, of Manchester, mechanical designer, and Richard Hurst, of Rochdale, in the same county, cotton spinner, for certain improvements in, and applicable to looms for weaving, and in machinery or apparatus for preparing, balling, and winding warps or yarns. March 7; six months.

Gerard John De Witte, of Brook-street, Westminster, Middlesex, gentleman, for improvements in machinery, apparatus, metallic and other substances for the purposes of letter-press and other printing. (Being a communication.) March 7; six months.

John Tebay, of Hackney, Middlesex, civil engineer, for an improved meter for registering the flow of water and other fluids. March 7; six months.

Frederick Rosenborg, of Albemarle-street, Middlesex, Esq., and Conrad Montgomery, of the Army and Navy Club, St. James's-square, Middlesex, for improvements in sawing, cutting, boring, and shaping wood. March 7; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| March 1 | 2205 | R. W. Winfield | Birmingham | Sacking for metallic bedstead. |
| „ | 2206 | Robert Harris | Braunston, Northamptonshire | "The Annular Cultivator." |
| „ | 2207 | Nath. Clissold Finck | Gloucester | Pattern-cutting machine. |
| 2 | 2208 | Smiths and Co. | Edinburgh | Wick elevator. |
| „ | 2209 | James Firth | Belfast | Fire-bar for locomotive and other furnaces. |
| „ | 2210 | James Moon | Malton, Yorkshire | Chimney cap. |
| 4 | 2211 | John Sweet Willway | Denmark-street, Bristol | Phero-pneuma, or gas carrier. |
| 5 | 2212 | Edwin John Vickery | Great Dover-road, Borough | Merino bodied hat. |
| „ | 2213 | James Thomas Woodman | Walton-on-Thames | Leg and foot rest. |
| „ | 2214 | William George Barker | Old Cavendish-street | An elastic opening to be inserted in boots or shoes. |
| „ | 2215 | William Johnson | Farnworth, Lancashire | Lubricator. |
| 6 | 2216 | The Rev. Anthony Singleton Atcheson | Rector of Teigh, Rutland | Writing, travelling, or invalid's table. |
| 7 | 2217 | Samuel Sheppard | Birmingham | Pump with draught and stop-cock. |
| „ | 2218 | J. and C. Clark | Wolverhampton | Coffee-mill. |

## *NOTICES TO CORRESPONDENTS.*

*Mr. Bain's reply to Mr. Baggs has been received, and will be inserted in our next Number.*

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1388.] SATURDAY, MARCH 16, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## MR. VIGNOLES'S PATENT METHOD OF MANUFACTURING PEAT CHARCOAL, OR COKE.

Fig. 2.

## MR. VIGNOLES'S PATENT METHOD OF MANUFACTURING PEAT CHARCOAL, OR COKE.

The manufacture of good coke or charcoal from peat, which has been attempted in vain by various parties in England and Ireland during the last ten years, has, it appears, been carried out in the meanwhile with eminent success in several parts of Germany. Our eminent countryman, Mr. Vignoles, having, in the course of his professional labours on the continent, had practical experience of the excellence of the fuel thus produced, and made himself master of all the details of the process of its manufacture, has taken the necessary steps for its introduction, under patent, into this country. We extract the following description from the specification, which Mr. Vignoles has just enrolled in Ireland (March 10.)

*Description.*

The said invention has for its object to subject peat or turf to a certain high temperature, in such manner as to deprive it of the whole, or nearly the whole, of the water which it naturally contains, and, by the continuance of the same process, to convert the peat or turf into peat or turf charcoal or coke. One of the most important peculiarities of this invention is, that by the mode of applying heat to effect the objects herein proposed, little, if any, of the peat or turf is burnt to ashes and wasted; and that the heat most proper for the best results, as to the quantity of the turf, or peat charcoal, or coke, is with certainty commanded.

Turf charcoal, sometimes called peat coke, has been heretofore usually obtained by some direct application of fire heat, as by the operation called "stifling," or by carbonization in close vessels or retorts, or in various forms of furnace or oven, none of which methods possess the advantages above alluded to.

The following is a description of the general nature of this improved method of carbonization, for effecting which various forms of apparatus may be contrived.

The peat or turf, extracted from the bog by any of the usual methods, and dried in pieces of any convenient size, either by exposure to sun and air, or by artificial heat, or by both methods, is placed in an iron vessel of large capacity, called the "carbonizing vessel." Steam—generated in any form of boiler, at a pressure therein of from 45 lbs. to 60 lbs. per square inch, or upwards, above that of the atmosphere—is permitted to escape thence, and to pass into and through a number of tubes of iron, or other fit material, heated to a bright red heat by being placed in a furnace, or into and through any other suitable contrivance by which the steam issuing from the boiler shall, without losing its pressure (as therein), acquire an additional temperature—such that, on being permitted to escape from the heating vessel, which I shall denominate "the coil," it shall have acquired a temperature equal to that of the melting point of tin, or even that of lead, or of from 450° to 600° of Fahrenheit, or thereabouts.

The surface of the coil receiving heat from its furnace should be proportioned to the generating power of the steam boiler, which may be done by gradually adjusting the surface of the coil, if not found proportioned in the first instance, so as to be capable of so elevating the temperature of all the steam the boiler can continuously supply at full pressure.

The steam, thus highly heated, or, as it has been sometimes called, "surcharged," is permitted to pass into the large vessel containing the dried, or partially dried, peat or turf. The effect of its contact therewith is rapidly to withdraw moisture in the state of steam from the peat or turf, which steam is permitted to escape from the vessel containing the latter, and which is called the "carbonising vessel;" and as it is desirable that a pressure above that of the atmosphere should be maintained in this vessel, the steam or vapour thus escaping from it (being that originally from the boiler, or part of it, and also that carried off from the peat or turf), may be advantageously used as a source of power, and applied either for the purpose of preparatory dessication of the peat or turf (as afterwards more particularly referred to), or for any other purpose.

After this drying process has gone on till the peat or turf has parted with nearly all its moisture, it begins to be charred or carbonised by the steam at the high temperature at which it is admitted into the carbonising vessel, and in proportion as the dehydration of the peat or turf advances, so does the temperature of the interior of the carbonising vessel increase until it approaches closely to that of the steam in the coil, which must be sufficiently high for the perfect carbonisation of the peat or turf. The process of passing this hot steam through the turf within the carbonising vessel is thus continued until the whole of the turf or peat it contains is found to be reduced to a black substance retaining the forms nearly of the original masses, but now almost a perfect vegetable charcoal or coke.

Fig. 1.

In this state the product of the carbonisation is liable to spontaneous combustion if withdrawn while still hot and exposed to the common air; to avoid this it may be left to cool in the carbonising vessel; but to save time and cost it is better to withdraw it quickly or to let it fall therefrom into an iron box of sufficient capacity to cover it closely therein, and then to fill the box with low-pressure steam once or oftener, and so let the charred turf or peat remain until it has got quite cold.

The turf, coke, or charred peat thus prepared may be applied to all purposes for which such fuel has been heretofore used, and from its great superiority to such fuel as made by any previous process, it is applicable to many other purposes also; as, for example, to metallurgic operations, and to locomotion by steam on land or water.

The following is a minute description of the form of apparatus, which has been found on actual trial to answer well for carrying through this process, and which I describe as the best with which I am at present acquainted; but I do not limit myself to this or to any other particular form of apparatus.

In the engravings accompanying this, fig. 1 shows a sectional plan of the whole system of apparatus. Fig. 2 a vertical section of the same through the lines AB, and partial elevation of the front CD. The vertical section of the steam boiler is through the line AB. The vertical section of the carbonising vessels through the same line, AB. And the horizontal section of the carbonising vessels numbered 1, 2, 3, 4, 5, 6, through the plane marked in vertical section by the line ST; and the horizontal section of the carbonising vessels numbered 7, 8, 9, 10, 11, 12, through the plane marked by the line UV. *a* is a cylindrical steam boiler, with a flue through the interior, set in brickwork in the usual way and provided with proper flues. On the right and left of this boiler are placed two complete sets of carbonising vessels; and as these are perfectly similar, and intended to be worked alternately, it will be sufficient to describe one of them; viz., the set numbered 1, 2, 3, 4, 5, 6. Each of these carbonising vessels is a cylinder of boiler plate with its axis vertical. The lower part of the vessel being conical, and provided at bottom with a steam-tight man lid or door for the emission of the charred peat, and the upper part being of a dome form, and provided with another somewhat similar man lid, for the introduction of the peat. These vessels are all set in brickwork, and provided with flues round their exterior, through which the heat, escaping from the flues of the steam boiler, may be conducted round any one or more of them in succession, for the purpose of, as much as possible, preserving their internal heat from being lost. Small separate fires may be used for this purpose, if thought desirable. These six cylinders are so arranged as to have a space in the midst of them for the heating coils of iron pipes marked H and I. These coils consist of two distinct sets or series of parallel tubes of malleable iron, or other suitable material, laid parallel and horizontal in the furnace for heating them, and which tubes are connected throughout, their ends being screwed into connecting pieces. H is the upper, and I the lower series of pipes in figures 1 and 2. At the end of the coil farthest from the fire-grate E, is placed an arrangement of valves or cocks (which must be so constructed as to be competent to withstand the high temperature and pressure of the surcharged steam), such that the steam from the boiler *a*, may be admitted or withheld from the coils, and that the steam, after having been heated in the first series of pipes of the coil, may be permitted to issue into any one or more of the carbonising vessels, and having lost heat and gained water by absorption from the peat therein, may be passed back thence into the second series of pipes of the coil (viz., the lower of the two as placed in the furnace) to be again heated or "revivified," and then again passed into one other or more of the carbonising vessels.

Three carbonising vessels are usually worked together; and while three are in operation, the other three may be either in progress of being filled or of being emptied.

Supposing the whole of the vessels 1, 2, 3, 4, 5, 6 already filled with turf, and steam up in the boiler *a*, and the coils at a bright red heat; the steam from the boiler is turned on to the uppermost series of pipes of the coil, and thence into the carbonising vessels Nos. 1 and 2, and thence back again into the second series of coils, and from these into the carbonising vessel No. 3. When the process of carbonisation is complete in all three, which is known by the disappearance of steam issuing from the escape pipes marked *v*, *v* in fig. 2 (vertical section), and by the issue therefrom of the peculiar odour of charring turf, then the process is stopped as regards these three vessels, and trial is made as to whether the whole of the turf therein be fully carbonised; and if this is the case, the operation is commenced in the same way with the vessels 4, 5, and 6, and the charred turf or peat is now let fall from each of the vessels 1, 2, and 3 by the man lids at bottom into the cooling boxes beneath, marked *p*, and a portion of steam from the boiler *a* is turned on into each, by a pipe provided for this purpose from the boiler; but which, to avoid confusion, is omitted in the figures. When the charring operation is complete in the vessels 4, 5,

and 6, the same is done by their contents. Meanwhile, the carbonising vessels 7 to 12 may be in progress of filling.

This describes the entire course of operations, and the best form of apparatus with which I am at present acquainted, so far as the carbonising is concerned.

Mr. Vignoles afterwards describes a method by which the steam or vapour escaping from the carbonising vessels may be turned to account as a means of effecting *a previous dessication of fresh supplies of peat or turf;* also an apparatus for partially freeing peat or turf from moisture by centrifugal action, constructed on the same principle as the hydro-extractor of Messrs. Manlove and Alliott—the adaptation of which principle to this particular purpose only is claimed.

LONDON FIRES IN 1849.—BY MR. W. BADDELEY, C.E., INVENTOR OF THE PORTABLE CANVASS CISTERNS; IMPROVED SPREADERS; FARMER'S FIRE ENGINE; EVERY MAN HIS OWN FIREMAN, ETC., ETC.

"The statistics of London fires are by no means devoid of interest, and the time may come when they will form an index to the social advancement of the people; for in proportion as houses are built more and more fire-proof, and habits of carefulness become more and more diffused, the number of destructive fires will assuredly lessen."—*Knight's London.*

Although we cannot yet boast of any very great improvements, either in the construction of metropolitan buildings, or in the habits of their inmates, *destructive fires* continue to decrease. The whole number of fires recorded in 1849 is 838, being 33 more than the preceding year, but only 2 more than happened in 1847. Taking the known increase of houses into the account, an actual decrease of fires would appear. There is an increase of one, in the number of totally destroyed as compared with 1848. In no one instance, however, was more than one building totally destroyed, a more favourable circumstance than has ever before been recorded in the annals of the London Fire Establishment.

Of last year's fires, 308 were extinguished by the prompt exertions of the inmates themselves; 301 have been extinguished by the inmates with casual voluntary aid; while the extinguishing of 229 has devolved upon the firemen. The total number of calls was 1003, as shown by the following tabular epitome:—

| MONTHS. | Number of Fires. | Fatal Fires. | Lives Lost. | Chimneys on Fire. | False Alarms. |
|---|---|---|---|---|---|
| January ...... | 78 | 0 | 0 | 7 | 13 |
| February .... | 63 | 3 | 7 | 10 | 8 |
| March ...... | 76 | 0 | 0 | 11 | 6 |
| April ........ | 56 | 2 | 2 | 10 | 4 |
| May ........ | 70 | 5 | 7 | 10 | 4 |
| June ........ | 61 | 2 | 2 | 5 | 4 |
| July ........ | 65 | 0 | 0 | 5 | 9 |
| August ...... | 84 | 0 | 0 | 4 | 8 |
| September .... | 80 | 2 | 2 | 2 | 8 |
| October ...... | 65 | 1 | 4 | 5 | 6 |
| November .... | 68 | 2 | 2 | 9 | 4 |
| December .... | 72 | 0 | 0 | 11 | 2 |
| Total ..... | 838 | 17 | 26 | 89 | 76 |

| | |
|---|---|
| Of these, there were totally destroyed.......... | 28 |
| Seriously damaged .......... | 228 |
| Slightly damaged.......... | 582 |
| | 838 |
| Chimneys on fire .......... | 89 |
| False alarms .......... | 76 |
| Making the total number of calls.......... | 1003 |

| | |
|---|---|
| The number of instances in which insurances were known to have been effected upon the building and contents, was | 368 |
| On the building only | 163 |
| On the contents only | 72 |
| The number of uninsured was | 235 |
| | 838 |

In the number of *fatal* fires there is an increase of *one*, but the number of lives lost is unusually large, many of them under circumstances of peculiar poignancy, as afterwards explained.

The fatal accidents may be classed as follows:

| | |
|---|---|
| Personal accidents from the ignition of bedding or wearing apparel | 13 |
| Explosion of fireworks (two fires) | 5 |
| Inability to escape from burning buildings (two fires) | 8 |
| Total number of lives lost | 26 |

The number of lives saved by the Royal Society for the Protection of Life from Fire has been .......... 18

The following fires are deserving of notice:—

Sunday, January 14, 4¾ A.M. No. 2, New-square, Lincoln's Inn At the time stated smoke was perceived issuing from the basement by a police constable, who immediately gave an alarm. The inn engines were soon got out; two of the Royal Society's fire-escapes, and engines from the Brigade stations, were quickly at the gates, but (as in the case of the Temple fire a few years back) admittance was for some time denied them. At length they obtained an entrance, and seven of the Brigade engines, with the West of England, were soon in full work upon the fire. The fire-escapes being raised, a number of deeds and other valuable documents were saved from destruction by the conductors, who continued their exertions until they could no longer do so with safety. The exertions of the firemen soon arrested the progress of the flames, and the auxiliaries, who had been working at several of the engines, had been paid off, when the flames burst forth again with greater fury than ever; fresh gangs of workmen manned the various engines, and messengers were dispatched to summon Mr. Braidwood to the spot; on his arrival the most energetic measures were adopted to extinguish the flames and to prevent their threatened spreading. From the age and peculiar arrangement of these antiquated buildings, however, this was a work of great difficulty, and was not effectually accomplished until Sunday afternoon.

After this fire an inquiry into the circumstances attending its outbreak took place before the Benchers; Mr. Braidwood was examined by them, but the firemen and fire-escape conductors, who were first on the spot, and were refused admission, were not called upon to speak to these, and other important facts, of which they were cognizant.

Monday, January 15, 2¼ A.M. No. 46, Bermondsey-street. Messrs. John and William Scallard, egg and butter merchants. At the time stated, twenty-three persons were located in these premises, when a policeman who was passing saw an appearance of fire and roused the inmates. It was some time before he was admitted, when he found the shop on fire, as also the cellar. By the prompt arrival of the Fire Brigade from the Tooley-street station, the fires were soon extinguished.

The fact of the two distinct fires, and the absence of property, in the face of a heavy insurance, looked so suspicious, that Mr. W. Payne, the coroner, held a court of inquiry into the circumstances; when it appeared that William Scallard had insured the stock in the General Assurance Company for 320*l.*, and soon after the fire, sent in a claim for 128*l.*; viz., 90*l.* for forty firkins of butter, and 38*l.*, for fixtures. All the stock found in the shop was three eggs and a piece of butter about an inch deep in the end of a cask. Mr. Henderson, brigade foreman of the district, said, "Had he not been told by Mr. Scallard that he was a cheesemonger and egg merchant, he should have returned him as a dealer in *empty* barrels." A mass of circumstantial evidence inculpating the brothers being adduced, the jury returned a verdict that "The house was wilfully set on fire by William and John Scallard." The verdict having been returned, the coroner asked Mr. Oughton, the actuary of the office, what steps the Company intended to take in the matter? Mr. Oughton: "I am not aware that the office will do anything. This inquiry is for the safety of the public. Insurance companies do not like prosecution, but in this case I can make no promise." The Coroner (with some warmth): "I know what that means; that nothing will be done, and that these men will be allowed to escape, as in previous cases. If I take the trouble to hold these investigations, surely you might assist in punishing the guilty parties." Mr. Oughton: "We do not like to prosecute; but if an action is brought against us for the recovery of the money, we shall resist, and prove what we know." The Coroner: "Yes, that's it. As long as you have not to pay the money you don't care. I am sure that, by holding these investigations, I have saved the insurance offices thousands of pounds, and I think it, I will not say disgraceful, but highly reprehensible, that I am not assisted. There is no public prosecutor, and unless the office does its duty, these men must escape." The inquiry then closed, the two men against whom the verdict was found being left at liberty.

The late respected magistrate for South-

wark, Mr. Cottingham, seeing these remarks of Mr. Payne, at once ordered the police to apprehend the guilty parties, who were accordingly taken into custody, and after two examinations, committed to take their trial at the Central Criminal Court, where they were indicted for feloniously setting fire to a dwelling-house, the property of Joseph Goodchild, with intent to injure him, found guilty, and ordered to be transported for life.

Thursday, January 25, 1½ A.M. No. 109, Bunhill-row. J. Walsh, victualler; sign of the "White Swan." This fire commenced among some loose wood in the cellar, and when discovered had extended to the bar parlour and staircase, so as to cut off the escape of the inmates—Mr. and Mrs. Walsh and their niece. The Brigade engine from the Whitecross-street station, was promptly on the spot, quickly followed by Conductor Clements with the Royal Society's fire-escape from the Aldersgate-street station; on his arrival he found the three persons named at the second floor window endeavouring to escape by tying blankets together, the smoke ascending round them in great density. With the aid of two of the Brigade, he succeeded in bringing them all safely down his escape. Mr. Walsh, in expressing to the secretary his gratitude, states—

"My wife and niece and myself would undoubtedly have perished but for your man's timely arrival, as all communication by the stairs was cut off—too much praise cannot be bestowed upon the conductor, for thus saving the lives of three persons."

Thursday, February 8, 10½ P.M. No. 34, Lamb-street, Spitalfields. D. I. M'Kellar, haberdasher, occupied the shop and first-floor; the second-floor was occupied by a Mr. Sutton and family, and the third-floor by a Mr. Newland, his wife, and child. At the time stated, a violent ringing at the bell caused Mr. Sutton to go down stairs, when he instantly returned, crying "fire." Mr. Newland, on hearing the alarm, snatched his child out of his wife's arms, and ran down stairs, telling her to follow him. As Mr. Newland quitted the house, Police Constable Blake came up, and joined in spreading the alarm; on perceiving the fire burning in the parlour behind the shop, he attempted to break a panel in the partition which separated the shop from the staircase; but while attempting to do so, the whole of the partition fell down, and the draught of air thus admitted, caused some inflammable matter in the shop to take fire, the flames and smoke rushing up the stairs and preventing the descent of the inmates. Mr. Newland, finding it impossible to re-enter the house, entreated some of the bystanders to go for the fire-escape; but no one being willing to undertake this humane errand, and lose "the sight," he went himself, shouting "fire! fire!" as he ran. The fire-escape Conductor (Smith) being on the alert, and hearing a cry of "fire" in the distance, prepared to start with his machine; and no sooner had Mr. Newland apprized him of the locality of the fire, than he hastened thither with all possible speed. A police-serjeant had passed the escape station a few minutes before on his way to the engine station, but gave the fire-escape Conductor no notice of the outbreak! Having been informed by Mr. Newland, as they went along, that the parties were most likely all in the second-floor, the conductor placed his escape, and entered the second floor window. The room was then so full of smoke as to be unbearable, and the search proved it to be empty. At this moment, the cry was raised in the street, "They are on the roof!" the Conductor accordingly ascended to the roof, but found no person there, the report having originated in some of the neighbours being seen there, having gone up to try to render assistance. By this time, the smoke and flames issuing from the lower part of the house enveloped the fire-escape, and the Conductor was forced to descend. Having shifted his escape to windward, he again mounted the roofs, but without any successful result.

The Artillery, Spitalfields, and Brigade engines rapidly arrived, and the fire was soon extinguished. Upon entering the third floor, the firemen discovered the bodies of Mr. Sutton, his wife, child, and a female servant, as well as that of Mrs. Newland, all of whom appeared to have been suffocated while making for the trap door to the roof, which opened out of that room.

An inquest was held upon the deceased five persons before Mr. Baker, the Coroner, when the preceding facts were proved in evidence. Mr. Hodsoll, assessor of losses to the Sun Fire-office, stated that Mr. Duncan James M'Kellar, the landlord of the house, had insured his stock and furniture in that office *one week before the fire*, for 300*l*. The inquest was three times adjourned, and the jury, at the close of their fourth meeting, returned a verdict "that the deceased persons lost their lives by suffocation, but how the fire occurred, there was not sufficient evidence to prove."

Mr. M'Kellar sent in a claim to the Sun Fire-office for the full amount of his insurance; but the stock and furniture having been valued at less than half that amount by their assessor, the smaller sum was awarded him; this he at first declined to take, but ultimately accepted.

Saturday, February 10. No. 16, High-street, Aldgate. Mr. Dunkley, wholesale shoe warehouseman. These premises were exceedingly lofty, and the flames having gained the staircase before the fire was discovered, every floor from the ground floor to the attic was soon one general blaze. Great fears were for some time entertained that the adjoining equally lofty premises of Messrs. Moses and Co., wholesale clothiers, would be involved in the destruction. The great height of these buildings fully tested the capabilities of the several fire-engines; and the working of the new one belonging to the West of England Company* was much and deservedly applauded.

Monday, March 12, 2½ A.M. The Britannia public house, Britannia-place, Bishopsgate-street. This fire broke out in the bar, or bar-parlour, and cut off the escape of Mr. Greenall, the landlord, and the barman, who were sleeping up stairs, and who, on being roused, got on to the roof; but the house being detached, they could get no further. Conductor Smith, with the Royal Society's fire-escape, was instantly in attendance, and being unable to get his machine down the court, he unshipped his upper ladder, and, joining it to his first-floor ladder, ascended the roof, and brought down the landlord and barman in safety. By the prompt attendance of the Brigade, with their engines, the fire was soon extinguished before the flames had made much progress beyond the bar and bar-parlour.

Tuesday, March 20, 10¾ P.M. Mr. D. Bowman, oil and colourman, No. 3, Tottenham Court-road. The fire was discovered raging furiously in the shop, and an alarm being given, Conductor Chapman, with the Royal Society's fire-escape from Hart-street, was promptly on the spot. On his arrival, the staircase was in flames, and he was told that several persons were in the house, although

* Mentioned in my last year's Report, *vide* vol. I., p. 259.

they did not appear. Chapman placed his escape against the second floor window, ascended, and entered, although a volume of dense black smoke was pouring from the window, which nearly overpowered him, and instantly extinguished his lamp. Three others were successively handed up to him, and one remaining alight, he commenced a search. Calling aloud, he was answered by a kind of stifled cry from a back room, which he entered, and encountered a man, who groaned out, "Oh, save my wife!" Groping about, the Conductor laid hold of a female quite exhausted, but clasping two children in her arms. Having brought them all into the front room, he placed them safely in the canvas trough of the escape, and they reached the street without injury. The Conductor followed them down in a dreadful state of exhaustion, having achieved the most heroic rescue of life from fire ever recorded.

With reference to this fire, Mr. Pyman, of 7, Gough-square, called upon a gentleman of the Committee the next morning, and stated—

"I have been many years a subscriber to your Society, highly approving of its objects, but its operations I knew nothing of until last night; I was passing the fire at Tottenham Court-road, and shall never forget how the inmates were saved by your 'Escape.'—The extreme perseverance of the Conductor to save them at the hazard of his own life was beyond all praise."

Another spectator states—

"We thought when he jumped in at the second floor window that we should not see him again alive, and I cannot tell you how he was cheered when he appeared with the woman and her two children."

Mr. Thos. Paine, of 7, Theobald's-road, writes—

"I was passing at the time, and was greatly aarmed for the safety of the inmates; but your 'Escape' was very quickly there, and placed against the house, the Conductor jumping in at the window, when I never expected he would get back again. You may judge my feelings when, in a few minutes of terrible suspense, I witnessed his return with a female and two children, and afterwards her husband. I am quite sure their lives would all have been lost had it not been for your 'Escape,' and the gallant exertions of your Conductor."

Thursday, March 29, 5½ P.M. The Olympic Theatre, Wych-street. It appears that Mr. Stirling, the stage manager, whilst standing on the stage, had his attention directed to the curtain, and saw flames running up the lining. He immediately called the carpenters together, and told them to cut the leech lines. The men mounted the wings, and having divided the cords, the curtain partially fell, but the lines still remaining on the other side of the curtain, the flames mounted upwards into the machinery, and very soon extended to the lawn coverings of the boxes and gallery, so that in five minutes every part of the theatre was fired and surrendered to its fate.

The flames were first seen from the outside of the theatre by a constable. Messengers were instantly dispatched in all directions for the engines, but before sufficient time had elapsed for one to reach the scene, the whole of the roof, gallery, and boxes were in a general body of flame; and so intense did the heat become, that six or seven houses in Craven-buildings, with the Pavilion Tavern, situate in Newcastle-street, and several other houses, caught fire simultaneously. The firemen mounted the roofs of the houses not on fire, and by that means were enabled to extinguish the fire in the Pavilion Tavern, and also to keep the flames from spreading further in the direction of Craven-buildings, although it was several hours before the fire in those last-named premises was wholly extinguished. The main body of fire in the theatre continued to blaze high in the air, completely illuminating the district, until a fearful crash was heard, caused by the falling of the gallery and boxes. This had hardly subsided when the roof fell in, and for a moment this appeared to damp the flames, but they afterwards burst forth with still greater vehemence, and myriads of sparks were wafted over the house-tops to a great distance. The fire having in some measure been got down in the surrounding houses, the whole force was brought to bear on the theatre, when the front of the same, from the first floor, fell into Wych-street. Jones, one of the firemen of the West of England engine, had the branch knocked out of his hand, and narrowly escaped being buried in the ruins. By eight o'clock the fire was so far got under as to allay all fears of any further extension, but there still remained a great body of flame amidst the ruins, and this was not completely extinguished until near eleven o'clock.

In addition to the total destruction of the theatre, twenty other buildings were (many of them severely) injured.

The Olympic Theatre was erected by old Philip Astley, His Majesty George III. giving him an old 74-gun ship for the purpose, the masts of which stood conspicuous during the conflagration.

Monday, April 2, 6 P.M. Mr. Tilliard, oil and colourman, 23, Great Suffolk-street, Southwark. This fire broke out in the cellar, and in a very short time communicated to every part of the building. In addition to the combustible materials with which the place was stocked, there was in the upper part of the warehouse a large quantity of gunpowder, which, when reached by the flames, exploded with a tremendous report, carrying the roof into the air, and totally destroying the walls. It was fortunate that the want of a supply of water procrastinated the operations of the firemen and the engines, for if they had been on the spot which they would probably have occupied, there is every reason to believe the loss of life would have been very great from the fall of the ruins and the effects of the explosion. The inmates of the upper part of the warehouse had scarcely time to escape, and it was with great difficulty that the daughter of Mr. Tilliard, and a boy about nine years old, with his sister, about five years old, and the shop-boy, succeeded in getting into the yard; their clothes were on fire, but, fortunately, by the exertions of their neighbours, they were dragged out of the premises, and assisted over a back wall into Revel's-row. A lad in the employ of Mr. Tilliard was injured by an explosion which took place in the shop, and he was removed to Guy's Hospital. Water was eventually obtained, and the engines of the London Brigade and West of England Company succeeded, by 9 o'clock, in extinguishing the flames.

The churchwardens of St. Saviour's having awarded a diminished scale of rewards to the three first engines, the firemen refused to accept it, and carried their case before the magistrates, who, being apprized of the exertions made, and the risk incurred by the firemen upon this occasion, decided that it was a case which called for the *full reward*, and ordered the churchwardens to pay the same.

Wednesday, May 2, 9½ P.M. 57, King William-street, City. Mr. C. J. Devereux, hatter. Serjeant Martin, of the City Police, in passing, observed an unusual glare of light in the shop, which induced him to go to the door, when he distinctly heard a crackling of something burning; he instantly sprang his rattle, cried "Fire!" and dispatched messengers for the required assistance. Almost simultaneously, a body of smoke burst from the third-floor

window, from which also fell two females—Mrs. Devereux and her eldest daughter; being both severely injured, they were conveyed to St. Thomas's Hospital, where the mother expired in about three-quarters of an hour. The alarm of fire being heard by another constable near the western extremity of King William-street, he immediately communicated with Hayward, Conductor of the Royal Society's fire-escape stationed at the Royal Exchange, who started with his machine, and reached the fire within three minutes of the outbreak. On his arrival, he was first called into the adjoining house, in consequence of some person being seen at the back, which proved to be Mr. Devereux's youngest daughter. Hayward then mounted his escape, and entered the second-floor room, on opening the door of which he found the whole of the staircase in flames; he therefore carefully closed the door, and ascended to the third-floor; but the flames and smoke issuing from the window, rendered it impossible for him to enter The Parish, Brigade, and West of England engines followed each other in quick succession; and a good supply of water being obtained, the most judicious arrangements were made to arrest the progress of the fire. The Brigade fought their way most gallantly up the burning staircase, great assistance being afforded them by the branch of a parish engine led up by the fire-escape into the third-floor room, and by other branches at the back of the burning building. As soon as the fire was extinguished, the bodies of two children (Lucy and Emily Devereux) were found lying close under the third-floor window from which the other females had thrown themselves.

An inquest on the mother and her two daughters was held before Mr. Payne, the Coroner, when evidence confirmatory of the preceding statement was given. It also appeared that the family had rushed upstairs to the trap-door on the landing, *but the ladder was missing*,—it was afterwards found in the kitchen, basement floor. They then ran into the front room, but *neglected to shut the door*, so that the smoke and flames quickly followed them. Had they closed the door, they might have continued in perfect safety many minutes; the doors of the first-floor rooms, and of the second-floor front room being shut, *no fire entered either of them*, and had the inmates remained in the second-floor room, they might have staid the whole time the fire was burning, uninjured.

Considerable doubt existed as to the origin of the fire; eventually, however, the jury returned a verdict to the effect "that the deceased persons met their deaths by the fire, which arose from accident." Circumstances subsequently transpired that justified a belief that this fire was *not* the result of accident.

Sunday, May 6, 4½ A.M. William's Mews, stables at the back of 24, Portland-place, Regent's-park. When the fire was discovered an instant alarm was given, and assistance promptly arrived, yet so rapidly did the fearful element extend, that before the coachman Jennings had time to get up, the whole of the lower part of the building became enveloped in flame. Jennings succeeded in bringing two horses out uninjured; but, while in the act of leading the third out, the heat became so great as to overpower both man and horse, and they fell in the midst of the flames. The kicking and plunging of the horse made some of the bystanders enter for the purpose of looking after the man, when a police constable of the A division succeeded in pulling the unfortunate man out, so seriously injured as to be obliged to be removed to the hospital, where he died on Thursday morning at five o'clock.

Plenty of water having been obtained, the engines were set to work, but the firemen were unable to get the mastery over the flames until the stabling, coach-house, three valuable carriages, and a horse, were burnt; besides which, the rooms occupied by the coachman and his family were destroyed, and their contents consumed.

Thursday, May 10, 7¾ P.M. A fire, attended with fatal consequences, broke out upon the premises occupied conjointly by Mr. Roberts, an auctioneer, and Mr. Lloyd, a solicitor, No. 7, Old Jewry, Cheapside. It appeared that a young man, named Mears, a clerk to Mr. Lloyd, was engaged on the first-floor warming a quantity of gold size, when it boiled over, and the contents of the saucepan became ignited, and blazed away with great fury. The unfortunate man then took the saucepan off the fire, and was, it is supposed, in the act of carrying it down into the street, when his foot slipped, and the fiery liquid ran down the staircase, setting it in flames, and at the same time running over the man's body. The poor fellow succeeded in reaching the street, the flames blazing over his head. After running to and fro for some time, he at length fell in the street, and some persons having thrown water over him, the fire about his person was extinguished. The engines of the London Brigade from Watling-street promptly attended, and the firemen soon extinguished the flames. Mears subsequently died from the effects of his severe injuries.

Friday, May 25, 11¾ P.M. No. 11, King-street, Portman-square. Mr. Jones, oil and colourman. The fire commenced in the cellar, and had got hold of the joisting and flooring of the shop before it was discovered, by which time the smoke rendered the passage impassable. On the arrival of Conductor Hutchings, with the Royal Society's fire-escape from the corner of the street, he found the servant girl, Susan Malls, in the second-floor, and brought her down the escape in safety. It being reported that some one else was in the premises, he thoroughly searched all the rooms, but found them tenantless. The Brigade firemen from the adjacent station soon arrested the progress of the flames.

Wednesday, June 6, 1 A.M. 152, Bermondsey-street, Mr. Claggett, oil and Italian warehouseman, nearly opposite Bermondsey Old Church. The flames were first discovered by Miss Claggett, who, whilst lying in bed on the second floor, was almost suffocated with smoke which entered her apartment. Feeling convinced that the building was on fire, she aroused the other inmates, consisting of Mr. Charles Claggett, his brother, and the shop-boy, and the whole of these parties got up immediately. They all succeeded in reaching the second floor front, and having made their appearance at the window, they called to the Conductor of the fire-escape belonging to the parish, stationed at the corner of the churchyard. The machine was taken instantaneously to the house, and having been raised to the second floor, the Conductor mounted, and placed Miss Claggett in the canvas bagging, when all of a sudden the carriage of the escape, not being securely held by those below, ran away from the building, and the top being jerked forward, struck the front wall with such force as to break the machine, when the bagging turned over, and the unfortunate occupant fell upon the pavement below. She was taken up senseless, and conveyed to the hospital. Tanner, the escape Conductor, also fell to the ground, and, although much hurt, he again placed his escape in front of the house, and, having ascended the same, he succeeded in saving the lives of the other two persons, viz., Mr. Charles Claggett and the shop-boy. Mr. Thomas Claggett

succeeded in getting out of one of the back windows, and forcing his body through a glass skylight, but in so doing he was frightfully cut over the body, and when he reached the street his night clothes were covered with blood. The engines of the parish, London Brigade, and West of England Company quickly attended; but the parish engineer had barely entered the shop, with the branch of his engine, when an explosion of gunpowder took place, which blew the front of the shop out, but fortunately the engineer escaped uninjured. Owing to the combined exertions of all parties, the fire was extinguished before it had extended beyond the shop. Miss Claggett, although much hurt, ultimately recovered from the effects of her fall.

Monday, September 10, 4½ P.M. No. 1, Oliver's-cottages, Market-court, Kensington. Mr. Jones, firework manufacturer, had nearly completed a large order for these dangerous articles, when his wife accidentally dropped a box of lucifers, which ignited and fired the whole of the stock, composition, loose gunpowder, &c., producing a tremendous explosion, by which the house (a small one) was entirely destroyed. Mr. Jones was much hurt, and his wife so severely injured that, on being taken out of the ruins, she was conveyed to the Kensington workhouse by the police. Everything was done for her that humanity or surgical skill could suggest, but without avail, and, after enduring the most excruciating agony, death put an end to her sufferings.

Saturday, October 6, 10¼ P.M. 66, London-wall. The premises in which the disaster commenced were in the occupation of Messrs. Gooch and Cousins, wool merchants, and were approached by a narrow gateway, but were adjoined on one side by the ancient building called Carpenter's Hall, and Draper's Hall was separated from the building by only the garden and fore-court in front. The premises in which the calamity commenced were nearly 279 feet long and three floors high, and were filled with some thousand pounds' worth of property.

With as little delay as possible, the Royal Society's fire-escape, with several Brigade engines, under the superintendence of Mr. Braidwood, and the West of England, under the command of Mr. Connorton, arrived at the spot. The scene which then presented itself was truly terrific, for the whole of Messrs. Gooch and Cousins's premises were on fire, from the base to the roof, and as the flames shot forth from the various windows, and through the roof, they ascended so high into the air as to illuminate not merely the whole of the City, but the greater portion of the eastern division of the metropolis.

Every possible exertion was made to arrest the progress of the flames in the numerous adjacent premises to which they had communicated, and eventually with success, but Messrs. Gooch and Co.'s warehouses were entirely destroyed, and nineteen other buildings more or less damaged.

On the following Tuesday, Mr. W. Payne held a Court of Inquiry, at the Crown and Cushion, corner of Winchester-street, for the purpose of investigating the circumstances connected with the outbreak of the fire. Several witnesses were examined, who detailed the circumstances under which the fire took place. It appeared that several persons had been at work on the premises, by candle-light, on Saturday night, until 8 o'clock. The jury returned the following verdict:—"They are unanimously of opinion that the fire was occasioned by accident, and they consider the using of candles in warehouses very dangerous."

The insurance companies sustained a net loss of 43,318*l.*, exclusive of damage to buildings, &c., by this fire, which is thus distributed:—Alliance Company, 9,820*l.*; London, 7,960*l.*; Royal Exchange, 7,749*l.*; Atlas, 7,473*l.*; Sun, 4,549*l.*; Imperial, 3,300*l.*; Legal and Commercial, 1,545*l.*; Globe, 85*l.* The salvage produced 27,022*l.*, which will go in reduction of those sums. Thirty-three persons not, or only partially assured, had wools to the value of 27,858*l.* on the premises at the time of the fire.

While the preceding was at its height, another fire broke out, Sunday 7, 1 A.M. No. 12, Shouldham-street, Bryanstone-square. Mr. Bex, beer-shop keeper. The lower part of the premises being discovered to be on fire, and all escape cut off, messengers were despatched for assistance. Conductor Clark with the Royal Society's escape from Edgeware-road, and Conductor Sunshine with the King-street escape, were promptly in attendance; the arrival of the former was hastened by meeting several messengers describing the imminent peril of the persons in the burning building, and he had the unspeakable gratification of reaching the spot in time to rescue all the inmates, consisting of Mr. and Mrs. Bex, two children, and a female servant, who were got out of the second floor window in their night dresses, and brought safely down the fire-escape, amid the heartfelt cheers of the anxious crowd below.

Friday, October 12, 10¾ P.M. No. 4, New Brook-street, Bermondsey New-road. Mr. Barling, firework-maker. At the time stated there were thirteen persons on the premises, viz., Mr. and Mrs. Barling, eight children, a nephew, a female servant, and a workman named George Barlow. Several persons were pursuing this hazardous occupation in the lower floor, lighted by an *open candle* and a *naphtha lamp!* From some unknown cause the lamp was upset, pouring a stream of liquid fire among the fireworks, when the whole exploded with fearful violence, and in a few minutes the house was on fire from top to bottom. Information of the misfortune was promptly forwarded to the engine stations, and, with as little delay as possible, the engines of the London Brigade, with Mr. Henderson, the district foreman, and Mr. Connorton, with the West of England engine, arrived at the scene of destruction, and every effort was made to arrest the spread of the fire. That having at length been accomplished, the firemen learnt that several persons were supposed to be in the ruins. Search was therefore made for the persons missing. After some time spent in turning over the ruins, the firemen discovered the bodies of two persons on the ground floor, Mr. William Barling, aged 20, son of the proprietor, and George Barlow, a workman; every vestige of wearing apparel was gone, and the bodies frightfully burned. On further search, the bodies of James Barling, aged four years, and Thomas Barling, aged 18 months, were found on the joists of the upper floor much mutilated.

Tuesday, October 23, 5¼ P.M. 126, Lower Thames-street. Messrs. Baiss, Brothers, and Co., wholesale druggists. These premises comprised two houses in Lower Thames-street, and extended backward to King's Head-court. A person in the warehouse was pouring out some sweet spirits of nitre with a naked light, when the vapour of this highly inflammable substance took fire, and the whole of the ignited spirits filled the warehouse with streams of liquid fire, which ran in all directions, and compelled the inmates of the premises to make a precipitate retreat. The moment the occupiers of the building had escaped into the street, they despatched information of the disaster to the various engine stations. Owing, however, to the very combustible nature of the stock in trade on the premises, the flames travelled with unusual rapidity, so that in the space of a very few minutes the fire had gained possession of the whole range of buildings, and was rushing out of the various win-

dows in King's Head-court, as well as through the different apertures in the premises in Thames-street. The flames at that period extended almost as far as St. Magnus's Church in one direction, whilst, in the other, house after house in King's Head-court became ignited either at the backs, fronts, or roofs, so that the reflection of the flames could be seen for miles distant. Eleven engines from the Brigade stations, that of the West of England, two from Messrs. Calvert's brewery, the Custom's engine, six parish and numerous wharf engines, were successively brought up and set to work, around the vast extent of burning buildings. A tolerably good supply of water was flowing from the New River mains, but it was wholly inadequate to supply the numerous engines there assembled, and quite unequal to the exigency of the occasion.

The floating engines of the Brigade were brought from Southwark-bridge and Rotherhithe, and their enormous powers brought to bear upon the mass of fire raging in Messrs. Baiss and Co.'s premises. For a long time but little impression was made by the torrents of water which were most skilfully directed from the most judicious positions upon the burning mass. Although great efforts were made to save as much as possible of Messrs. Baiss and Co.'s premises, the great object of the firemen was to stop the progress of the fire in the numerous adjacent premises to which it had communicated; and eventually their exertions were crowned with well-deserved success, the destruction being much more circumscribed than was anticipated by any person who witnessed the violence with which the combustible contents of Messrs. Baiss and Co.'s premises for a time burned, and exploded. The back warehouses in King's Head-court were burned out, the two front houses about half destroyed, and fifteen surrounding premises more or less damaged.

On Friday, Mr. Payne assembled a Jury of merchants in the Vestry of St. Magnus. Several witnesses were examined, and it appeared from their evidence that the fire was occasioned by the ignition of spirits of nitre—an uncovered lamp having been imprudently used by one of the apprentices pouring some of that liquid from one vessel into another. The Jury found that the fire was the result of accident.

The daily distribution of last year's fires has been as follows:—

| Monday. | Tuesday. | Wednesday. | Thursday. | Friday. | Saturday. | Sunday. |
|---|---|---|---|---|---|---|
| 114 | 131 | 102 | 131 | 105 | 139 | 116 |

Their distribution throughout the day and night has been in the following proportions:—

| | First hour. | Second hour. | Third hour. | Fourth hour. | Fifth hour. | Sixth hour. | Seventh hour. | Eighth hour. | Ninth hour. | Tenth hour. | Eleventh hour. | Twelfth hour. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A.M. | 58 | 32 | 45 | 24 | 18 | 19 | 14 | 13 | 12 | 20 | 19 | 13 |
| P.M. | 21 | 16 | 17 | 22 | 34 | 41 | 55 | 57 | 62 | 96 | 85 | 45 |

The following list shows the occupancy of the premises, with reference to those portions of them in which the fire originated; thereby illustrating the comparative liability to accident by fire of various trades, manufactories, and private dwellings:—

| Occupation. | Totally Destroyed. | Seriously Damaged. | Slightly Damaged. | Total. |
|---|---|---|---|---|
| Apothecaries | .. | 1 | 1 | 2 |
| Bakers | 1 | 1 | 7 | 9 |
| Ditto, sea biscuit | 1 | .. | .. | 1 |
| Barge and boat-builders | .. | .. | 1 | 1 |
| Basket-makers | .. | .. | 1 | 1 |
| Bath-keepers | .. | .. | 1 | 1 |
| Baths and wash-houses | .. | 1 | .. | 1 |
| Beershops | .. | 3 | 9 | 12 |
| Blacking-makers | .. | .. | 1 | 1 |
| Booksellers, Binders, and Stationers | .. | 5 | 9 | 14 |
| Brewers | .. | .. | 1 | 1 |
| Brokers, and dealers in old clothes | 1 | 5 | 4 | 10 |
| Builders | 1 | 4 | 1 | 6 |
| Butchers | .. | .. | 3 | 3 |

| Occupation. | Totally Destroyed. | Seriously Damaged. | Slightly Damaged. | Total. |
|---|---|---|---|---|
| Cabinet-makers.................... | 2 | 7 | 10 | 19 |
| Carpenters and Workers in Wood .... | 1 | 7 | 12 | 20 |
| Caoutchouc Manufacturers .......... | 1 | .. | .. | 1 |
| Chandlers ......................... | .. | 4 | 9 | 13 |
| Charcoal and Coke, dealers in ...... | .. | 2 | 1 | 3 |
| Cheesemongers .................... | .. | 1 | 2 | 3 |
| Chemists, including Laboratories .... | .. | 1 | .. | 1 |
| Churches ......................... | .. | .. | 1 | 1 |
| Cigar-makers ...................... | .. | .. | 1 | 1 |
| Coach-makers ..................... | .. | .. | 1 | 1 |
| Coal-merchants ................... | 1 | 1 | 3 | 5 |
| Coffee-shops and Chop-houses........ | 1 | 1 | 5 | 7 |
| Coffee-roasters..................... | .. | .. | 1 | 1 |
| Colour-makers ..................... | .. | .. | 1 | 1 |
| Confectioners and Pastrycooks ...... | .. | 2 | 5 | 7 |
| Cork-cutters ...................... | .. | 1 | .. | 1 |
| Corn-chandlers..................... | 2 | 1 | 3 | 6 |
| Distillers, Illicit .................. | .. | 1 | 1 | 2 |
| Ditto, of Tar .................... | .. | 1 | 1 | 2 |
| Ditto, of Naphtha.................. | .. | .. | 1 | 1 |
| Docks ........................... | .. | .. | 1 | 1 |
| Drapers, Woollen, Linen, & Silk-mercers | 1 | 8 | 12 | 21 |
| Druggists, wholesale................ | .. | 1 | 1 | 2 |
| Dwellings, private ................ | 1 | 48 | 286 | 335 |
| Dyers, silk ...................... | .. | .. | 1 | 1 |
| Eating-houses ..................... | .. | .. | 5 | 5 |
| Farming Stock ..................... | .. | 10 | .. | 10 |
| Fellmongers ...................... | .. | 2 | .. | 2 |
| Firework-makers .................. | 1 | 1 | 1 | 3 |
| Founders.... ..................... | .. | 1 | 3 | 4 |
| French Fancy-warehouses. .......... | .. | .. | 1 | 1 |
| Furriers and Skin Dyers ............ | 1 | 2 | 3 | 6 |
| Fruiterers ........................ | .. | .. | 2 | 2 |
| Gaming-houses .................... | .. | .. | 1 | 1 |
| Gas-works ....................... | .. | 1 | 5 | 6 |
| Grocers .......................... | 1 | 3 | 4 | 8 |
| Hat-makers ....................... | 2 | 8 | 2 | 12 |
| Hotels and Club-houses ............ | .. | 1 | 6 | 7 |
| Japanners ........................ | .. | 1 | .. | 1 |
| Lamp-black Makers ................ | .. | 1 | .. | 1 |
| Laundresses ...................... | .. | 2 | 3 | 5 |
| Leather Manufacturers.............. | .. | 5 | .. | 5 |
| Linen Manufacturers ............... | 1 | .. | .. | 1 |
| Lucifer Match-makers .............. | .. | .. | 3 | 3 |
| Maltsters ........................ | .. | .. | 1 | 1 |
| Manchester Warehousemen.......... | .. | 2 | 2 | 4 |
| Marine Stores, dealers in............ | .. | .. | 5 | 5 |
| Mattress-makers ................. | .. | 1 | .. | 1 |
| Milliners and Dressmakers.......... | .. | 1 | .. | 1 |
| Musical Instrument-makers.......... | .. | 3 | .. | 3 |

| Occupation. | Totally Destroyed. | Seriously Damaged. | Slightly Damaged. | Total. |
|---|---|---|---|---|
| Oil and Colourmen (not makers)...... | 1 | 6 | 6 | 13 |
| Painted Baise-makers .............. | 1 | .. | .. | 1 |
| Painters, Glaziers, and Plumbers .... | .. | 1 | .. | 1 |
| Paper-stainers .................... | .. | 2 | 1 | 3 |
| Pasteboard-makers ................. | .. | 1 | .. | 1 |
| Pawnbrokers........................ | .. | 1 | 1 | 2 |
| Perfumers, manufacturing .......... | .. | .. | 1 | 1 |
| Pipe-makers ....................... | .. | .. | 1 | 1 |
| Pork-butchers ..................... | .. | .. | .. | 1 |
| Potteries ......................... | .. | .. | 1 | 1 |
| Printers and Engravers ............ | .. | 1 | 2 | 3 |
| Ditto, Copper-plate ............... | .. | 1 | 2 | 3 |
| Public Buildings .................. | .. | .. | 1 | 1 |
| Rag-merchants...................... | .. | 3 | .. | 3 |
| Railways .......................... | .. | .. | 3 | 3 |
| Sack makers ....................... | .. | 1 | .. | 1 |
| Sale Shops and Offices............. | 2 | 18 | 17 | 37 |
| Saw-mills, Steam .................. | .. | 3 | 2 | 5 |
| Ships.............................. | .. | .. | 3 | 3 |
| Ditto, Steam....................... | .. | .. | 1 | 1 |
| Ship-builders ..................... | .. | 1 | .. | 1 |
| Soot Merchants .................... | .. | .. | 3 | 3 |
| Stables ........................... | 1 | 5 | 11 | 17 |
| Stay-makers ....................... | .. | 2 | 3 | 5 |
| Straw-bonnet Makers ............... | .. | 1 | 1 | 2 |
| Sugar Refiners .................... | .. | .. | 1 | 1 |
| Tailors............................ | .. | 4 | 5 | 9 |
| Tallow-chandlers, Melters, Wax-chandlers, and Soap-boilers ............ | .. | 2 | 2 | 4 |
| Tanners............................ | .. | 1 | .. | 1 |
| Tarpaulin Makers................... | .. | .. | 1 | 1 |
| Theatres .......................... | 1 | .. | 1 | 2 |
| Tinmen, Braziers, and Smiths........ | .. | 5 | 8 | 13 |
| Tobacconists ...................... | .. | 3 | 5 | 8 |
| Toy Warehouses .................... | .. | 1 | 2 | 3 |
| Under Repair, and Building........ | .. | 1 | 5 | 6 |
| Unoccupied ........................ | .. | 1 | 5 | 6 |
| Varnish-makers .................... | .. | .. | 1 | 1 |
| Victuallers, Licensed ............. | 1 | 5 | 31 | 37 |
| Wadding-makers .................... | .. | 1 | .. | 1 |
| Warehouses ........................ | 1 | .. | .. | 1 |
| Water-works........................ | .. | 1 | .. | 1 |
| Wharfingers ....................... | .. | .. | 1 | 1 |
| Wine and Spirit Merchants.......... | .. | .. | 8 | 8 |
| Wood Merchants .................... | .. | 1 | .. | 1 |
| Workhouse ......................... | .. | ... | 1 | 1 |
| Workshops (no hazardous goods or processes) ............ ........... | .. | 2 | .. | 2 |
| Total............... | 28 | 228 | 582 | 838 |

The causes of fire, so far as could be satisfactorily ascertained, appear to have been as follows :—

| | |
|---|---|
| Accidents of various kinds, for the most part unforeseen and unavoidable | 8 |
| Apparel ignited on the person | 2 |
| Bleaching nuts and ginger | 3 |
| Candles, various accidents with | 100 |
| ——, ignited bed-curtains | 74 |
| —— window curtains | 67 |
| Carelessness, palpable instances of | 20 |
| Cat upset chair, &c. | 2 |
| Children playing with candles | 1 |
| —— fire | 8 |
| —— lucifer matches | 6 |
| Cinders put away hot | 10 |
| Coke | 1 |
| Drunkenness | 7 |
| Ether, drawing off | 1 |
| Fire sparks | 40 |
| Fires kindled on hearth | 4 |
| Fires raked out on hearth | 2 |
| Fireworks, making | 2 |
| —— letting off | 6 |
| Flues, defective and overheated | 27 |
| —— in next house | 6 |
| ——, blocked up | 15 |
| ——, foul and ignited | 29 |
| Fumigation, incautious | 2 |
| Furnaces | 19 |
| Gas, escape of from street mains | 1 |
| —— defective fittings | 39 |
| ——, accidents in lighting | 3 |
| ——, burning too high | 9 |
| ——, making | 1 |
| ——, fittings, repairing | 4 |
| Gunpowder | 2 |
| Hearths, defective | 3 |
| Hot-air pipes overheated | 1 |
| Kilns, overheated | 2 |
| Lamps, oil | 2 |
| ——, naphtha | 15 |
| Lightning | 2 |
| Lime, slaking of | 3 |
| Linen drying or airing before fire | 40 |
| Lucifer matches, making of | 3 |
| ——, using | 9 |
| Naphtha, experimenting with | 1 |
| Ovens, overheated | 2 |
| Pitch, tar, and tallow, boiling of | 8 |
| Reading in bed | 1 |
| Spontaneous ignition of coals | 1 |
| —— cotton | 1 |
| —— dung | 2 |
| —— greasy rags | 1 |
| —— greasy rubbish | 8 |
| —— hay | 3 |
| —— lampblack | 6 |
| —— powdered charcoal | 1 |
| —— old rope | 1 |
| Shavings, loose, ignited | 21 |
| Soot put away hot | 2 |
| Steam-boilers, heat of | 3 |
| ——, explosions | 1 |
| Stills, illicit | 2 |
| Stoves, defective and overheated | 13 |
| —— in next house | 5 |
| ——, improperly set | 4 |
| ——, drying | 12 |
| ——, pipe | 3 |
| ——, portable | 3 |
| ——, ironing | 3 |
| Sugar, boiling of | 1 |
| Suspicious | 10 |
| Tobacco, unextinguished | 24 |
| Varnish, oil, &c., boiling of | 13 |
| Wilful | 19 |
| | 762 |
| Unknown | 76 |
| Total | 838 |

The causes of fire, it will be seen, are much of the usual character. I cannot help noticing the great number of accidents which are continually happening from the use of *turpentine* as a light producing agent, in the garb of *Naphtha lamps—Camphine lamps*—or *Portable gas lamps*. Many of these accidents have been attended with serious personal injuries, some of them ending in death. A more dangerous contrivance than these lamps (the latter especially) never entered a building.

Lucifer matches lead to many serious fires, sometimes without being for a moment suspected of the mischief. The following incident throws a light upon this subject:—An intimate friend of mine, of exceedingly careful habits, has a tin box for lucifer matches fixed inside a cupboard door in his kitchen; the lower part of this cupboard is a depository for waste-paper, shavings, and firewood. My friend going into the kitchen the last thing at night, a short time since, to see whether the fire was safely extinguished, doors bolted, &c., saw the cupboard door left partly open, and closed it. Before he left the room smoke began to issue from the cupboard, and opening the door he found the firewood, &c., was in a blaze. This incipient conflagration was soon extinguished, and a minute search made to ascertain its cause. It then became evident that some person, in taking out a lucifer match, had dropped one unperceived upon the floor. In closing the cupboard door the match had been smartly scraped upon the floor, and in consequence ignited, just as it entered the shavings, &c. Had the unconscious incendiary quitted the room before the smoke showed itself, the house would most probably have been destroyed, the origin of the fire being involved in the most profound mystery! A writer in the *Hereford Journal* recently observed,

"The danger of lucifer matches in any but experienced, careful, and honest hands, has often been pressed upon the public attention, and cannot be too much insisted upon. Convenient as they may be, they are worse than a two-edged weapon in the hands of an idiot, a child, or a villain. It were almost to be wished, considering the consequences that have attended upon the cheapness of them, that a duty would be laid upon them amounting nearly to a prohibition."

The number of fires that are known to have been wilfully occasioned is a source of painful regret.

The Insurance-offices appear to be the "refuge for the destitute" of insolvent shopkeepers. It is no uncommon occurrence for persons of little or no capital to take shops in new localities, attractively fitted up and filled with a showy stock, for which the adventurers find there are no buyers. Although "in an increasing and promising neighbourhood," the shopkeeper is unable to wait for "the good time coming;" while the grass grows the steed starves; the aid of the fire-king is invoked, and the insurance-office pays the piper. The frequency of such cases of late, leads to the belief that the fire-offices will be obliged to increase the rate of premiums upon such insurances much beyond what the honest tradesman ought to pay—or, to decline the insurances of new shopkeepers; thus saddling the upright and prudent with a risk they should not bear.

Incendiary fires have been very numerous during the past year in many agricultural districts. The counties of Essex and Suffolk, being the scenes of many of these agrarian outrages. Lord Thurlow has been out, night after night, with his engine and fire-brigade, to extinguish the numerous fires that have occurred within a few miles of his mansion at Ixworth. Although undiscovered for a time, the perpetrators of the mischief have in several instances been apprehended, and dealt with as such pests to society deserve. It will have been seen that Mr. Payne still continues to hold "courts of inquiry," upon all fires of doubtful origin within his district. There can be no doubt that great benefit has resulted from these proceedings; and it is highly desirable that an Act of Parliament should be passed legally authorising the holding of these courts, and giving full power (at present generally disputed) to the coroners, to act upon the verdicts given on such occasions. In his last annual Report to the Court of Common Council, Mr. Payne, after thanking the members of the court for the consideration with which they had been pleased to receive these communications, says:—"I request permission to remark that, in one of those cases the evidence implicated two men as having wilfully set fire to a house in the night-time (in which about thirty persons were residing), that these men were apprehended *solely and entirely* in consequence of the facts elicited at the inquest, and were convicted and transported for life. And I have the satisfaction to state that, during the five months which have elapsed since the conviction, there have been only three fires in London and Southwark requiring investigation; whilst, during the seven previous months of the year, there were as many as nineteen, and some of the officers of the Fire Insurance Companies have stated that that conviction has had a most beneficial effect in checking incendiarism in the metropolis."

THE LONDON FIRE ESTABLISHMENT, under Mr. Braidwood's superintendence, with the able assistance of Messrs Fogo, Colf, Staples, and Henderson, district foremen, continue to discharge the duties of their calling with their wonted zeal and intrepidity. If the occasions for extraordinary exertion have not been very numerous during the past year, they have been at least sufficient to show that there was no falling off in the *esprit du corps*.

THE WEST OF ENGLAND Firemen, under Mr. Connorton, still maintain the same conspicuous position they have so long held. In alacrity of turning out—in speed of travelling, and in zealous and judicious exertion—they are second to none. Their prompt arrival and praiseworthy conduct at many of last year's fires drew forth marked commendations, and in more than one instance led to the most flattering encomiums being forwarded to their employers.

THE ROYAL SOCIETY FOR THE PROTECTION OF LIFE FROM FIRE have not been found wanting during the past year. At the lamentable tragedies in Lamb-street, Spitalfields, and King William-street, City, circumstances were such as to render the exertions of the conductors unavailing. In the former instance, the want of timely notice, and, in the latter case, the extreme rashness and want of presence of mind of the persons in jeopardy, rendered rescue impossible. On reference to the preceding narratives, it will be seen that whenever the fire-escape conductors have been promptly apprised of the need of their services, those services have been most efficiently rendered, every difficulty has been surmounted—every danger braved. In consequence of the gallant rescue of Mr. Walsh and family in Bunhill-row, in January last, the parishioners of St. Luke's determined upon having an escape stationed in that parish, and entered into an arrangement with the Royal Society, who promptly carried out their resolutions.

The annexed engraving represents the *Royal Society's Balcony Fire-escape*, the joint production of several inventors whose plans were combined and successfully carried out by Clarke, the Society's builder. This escape consists of a strong main ladder, 38 feet high, mounted on one of Wivell's carriages; a light framed balcony, capable of holding four or five persons, runs upon iron tramways affixed to the sides of the ladder. The balcony is capable of being raised to the top of the ladder by a rope passing under a pulley at the lower part of the carriage. The back of the balcony can be lowered to the horizontal position, when it forms a bridge from a window to the balcony. A second ladder slides upon the first, and can be raised to a height of about 50 feet, by a rope carried like the former, through a pulley at the bottom of the carriage. The advantages claimed for this escape are—the great height to which it can be elevated, and the convenient mode of descent it offers to the parties needing it.

This escape has been adopted at the Royal Society's stations at the Royal Exchange, Trafalgar-square, Eaton-square, and Knightsbridge-green. This fire-escape is the first by which life was saved from fire within the city, viz., at the fire in Newgate-street, July 19, 1846, within three months of the Royal Exchange Station being formed.

A public meeting of the subscribers to the Royal Society was held in the Council Chamber of the Guildhall, London, on the 14th of May last, the Right Hon. Sir James Duke (Lord Mayor), in the chair, when numerous honorary and pecuniary rewards were given to parties who had distinguished themselves in saving life from fire. A detailed report of the Society's affairs* was read to the meeting, in which the Committee regretted that, "notwithstanding the very frequent proofs afforded of the public benefit accruing from their fire-escape stations, they cannot obtain a more speedy augmentation of their number, and thereby *do more* for the perfecting of the original design of the Society, viz., to provide, station, and maintain fire-escapes *throughout* London, at distances of half a mile from each other. The deaths caused by inability to escape from houses on fire in the metropolis have, during the past three years, *greatly decreased*, and they feel assured that, could the stations be so extended, THE SAME RESULT WOULD ATTEND IN AN INCREASED RATIO, *because*, every station formed in what, at the present, are intervening localities, MUST GREATLY AID THE EFFECTIVE WORKING OF THE WHOLE.

"Every station costs the Society for the first expenses of building fire-escape, watch-box, tarpaulin, &c., about 70*l.*, and the annual cost of maintaining each, with a Conductor, averages about 80*l.*; and your Committee take this public opportunity of stating, that having an earnest and great desire to extend this great public good all over London, they will endeavour to establish a fire-escape station in any district half a mile distant from the next station, where parochial officers will so far co-operate with them as to vote a donation of 50*l.* towards the first expenses, and 10*l.* 10*s.* a year towards the annual expenses, and *trust* to the *good feeling*, the *liberality*, and the SELF-INTEREST of the inhabitants of such district, to contribute sufficient funds *to continue the same in a state of efficiency*."

The report concluded by observing that, "The results attending the operations of the Institution, during the past year, confirm the Committee in their determination steadily to persevere in advocating the cause. They have no desire, on the one hand, to *exaggerate* the good they have been able to effect, or to presume upon it; neither, on the other hand, can they expect that at *every* fire where their assistance *is* rendered, it will necessarily result in the preservation of those endangered; but, *from a review of the past, they feel it to be the bounden duty of all*, as careful householders, as good citizens, or benevolent Christians, *to support such a practical means for the preservation of human life as this Society affords*; for while they strongly feel that to the blessing of God alone every instance of preservation must be attributed, *yet that blessing is not to be expected if the use of means be neglected.*"

December, 31, 1849.—Return of fires attended and lives saved since January 1:—

Number of stations—26 increased to 27.
Fires attended—220. Lives saved—18.

29, Alfred-street, Islington, Feb. 19, 1850.

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### ELECTRO-CHEMICAL DECOMPOSITION—MR. BAIN IN REPLY TO MR. BAGGS.

Sir,—It is, alas, the universal lot of inventors, so soon as their labours are crowned with success—either in the way of fame or fortune—to be beset by a host of pirates, and pretenders to "priority of invention;" and it is just the same whether the invention has been the thought of a moment, and its realization the work of a few hours; or, as in the case of my chemical telegraphs—it is the result of many years of study, hard labour, and a great expenditure of money. During the whole course of my efforts in extending scientific principles to use-

* Copies of which may be had at No. 169, Fleet-street.

ful purposes, I have never *knowingly* neglected to recognise and acknowledge the *legitimate* claims of my fellow-labourers in the same field; but I must decline to recognise *spurious* and *imaginary* claims, such as that set up by Mr. Isham Baggs in your last Number (page 163).

Whilst I was exhibiting my printing telegraph at the Polytechnic Institution, in 1841, Mr. Baggs came there with his patent method of *printing by electricity*, which was publicly exhibited and lectured upon by the professors of the Institution (in the same way as my printing telegraph); and I saw the process and heard the lectures over and over again, just as the public and Mr. Baggs saw the exhibition of my telegraph, and heard the explanation thereof.

I was not at that time aware that Mr. Baggs professed to have discovered any *new principle*, but had merely applied a well-known chemical fact (electric decomposition) to the purposes of printing in colours.

Not being aware of what had previously been done, I spoke to Mr Baggs about the application of this principle to my telegraph, whereupon he offered to sell me a license for that purpose. On making inquiry, however, I found that the principle of electro-chemical decomposition had been applied to telegraphs, and actually patented *two years before*, by Mr. Davy.

At page 143 of your 35th volume, I find a faithful abstract of Mr. Baggs' patent specification. In the first place, patterns were formed by pieces of different metals, and placed upon cloth or paper moistened with a solution of carbonate of soda, which received coloured marks from the metals when a galvanic current passed through them. Secondly, platinum wires were bedded in a glass plate, and paper moistened with iodide of potassium printed upon by frictional electricity. Mr. Davy's patent of 1839, according to Mr. Baggs' own statement, included the use of *platinum wires*, *iodide of potassium*, and *starch*, the printing being effected by an electric current!

There is *not*, however, either in the patents of Mr. Davy or Mr. Baggs *any chemical solution* available for the purposes of rapid telegraphic communication; none of the ingredients, as used by them, being sufficiently *sensitive* to be acted upon quickly by such feeble currents of electricity as are attainable at the termini of long telegraphic wires. Mr. Davy was well aware of this defect, and therefore did not use the currents from a distance to decompose the material employed, but made these currents act upon magnetic needles which completed the circuit of a supplementary battery in close proximity to the chemically prepared fabric; this, however, was an exceedingly slow process and required several wires for its working.

Now I have effectually overcome all the difficulties that stood in the way of *rapid* telegraphic communication by electro-chemical decomposition; not by means of anything that has been patented or discovered by Mr. Davy, nor by Mr. Baggs, but by combining and arranging principles, electrical, chemical, and mechanical (all of which are of themselves patent to the whole world), so as that, by means of a single wire—the earth forming half the circuit—I can transmit and record by the current, even through the largest circuit, conventional signs at the rate of *one thousand letters per minute;* and also produce a fac-simile of any writing, printing, drawing, &c. The arrangement and combination of these known principles, so as to produce this result (never heretofore accomplished) constitutes *my invention*, and I am not indebted to Mr. Baggs for any assistance; nor is he, or any other person, entitled to share any portion of this invention with me. I have never, in practice, employed any of the solutions or processes mentioned and claimed in Mr. Bagg's patent, having by long continued experiments discovered far more suitable ones for this purpose. Apologising for the length of this letter, I am, Sir, yours, &c.,

A. Bain.

Hammersmith, March 5, 1849.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 14TH, 1850.

Richard Archibald Brooman, Fleet-street, patent agent. *For certain improvements in draught-horses' saddles, harness, and saddle-trees.* (A communication.) Patent dated September 13, 1849.

*Claims.*—1. The employment of wrought or cast iron for the purposes described [that is to say, for the manufacture of those parts of saddlery and harness which

have hitherto been made of a combination of wood, iron, and leather.]

2. A mode of constructing cart and other saddles, Stanhope, and other pads, with steel plates, or hinge joints, so as to render them self-adjusting.

DAVID STEPHENS BROWN, of the Old Kent-road, Surrey, gentleman. *For certain improvements in apparatus or instruments for the fumigation of plants.* Patent dated September 13, 1849.

*Claims.*—1. The combination in apparatus or instruments for fumigating purposes of a magazine containing the fumigating substance with a cylinder and exhausting fan or wheel, whereby the smoke is drawn in at one part of the cylinder and driven out another, and whereby also the atmospheric air, necessary for the combustion of the fumigating substance, is drawn into it by the said fan or wheel.

2. The employment in such apparatus or instruments, as aforesaid, of a moveable curved pipe for giving the required direction to the smoke.

3. A fumigating stove, in the general arrangement and combination of parts of which the same consists.

4. An apparatus for fumigating by means of the vapour of liquid substances, in the general arrangement and combination of parts of which the same consists.

HENRY ATTWOOD, late of Goodman's-fields, Middlesex, and JOHN RENTON, late of Bromley, in the same county, engineer, but now both of Pimlico, in the same county. *For certain improvements in the manufacture of starch, and other like articles of commerce, from farinaceous and leguminous substances.* Patent dated September 13, 1849.

*Claims.*—1. The employment of a solution of lime, in conjunction with chloride of sodium or salt in water, in the manufacture of starch and other like articles of commerce, and that either before or after the rice is ground, crushed, or broken.

2. The employment, in the manufacture of starch, of lime-water prepared from lime and cold water.

3. The employment, in the manufacture of starch, of long shallow troughs, in connection with an exhaust pump, for the purpose of depositing from the water discharged by the pump any remainder of starch.

[The details of this invention in our next Number.]

THOMAS MARSDEN, Salford, machine-maker. *For improvements in machinery for heckling, combing, or dressing flax, wool, and other fibrous substances.* Patent dated September 13, 1849.

The patentee describes and claims—

1. The combination, in one machine, of the two systems of heckling; that is to say, causing the first set of heckles to enter the strick in an oblique position, and the second to enter it at right angles.

2. Causing the heckling surfaces to move to and from the material by a cam motion.

3. Applying the carding cylinder as a doffing cylinder.

EDWIN HEYWOOD, Glosburn, York, designer. *For improvements in plain and ornamental weaving.* Patent dated September 13, 1849.

These improvements, which could not be intelligibly described without the help of illustrative engravings, relate—

1. To cross weaving.

2. To arrangements for opening two sheds in the work, in order that two shuttles for ornamenting and weaving the fabric may be thrown simultaneously. And,

3. To certain arrangements for actuating the ornamenting shuttle in Jacquard looms.

BENJAMIN GOODFELLOW, Hyde, Chester, engineer. *For certain improvements in steam engines.* Patent dated September 13, 1849.

The patentee describes and claims—

1. A peculiar arrangement and construction of double-cylinder engine, in which the high-pressure cylinder is made to serve as the piston of the one in which steam is worked expansively.

2. A peculiar construction and mode of working steam valves, applicable to the above description of engine, and to those worked on the expansive principle generally.

JAMES POTTER, Manchester, machinist. *For certain improvements in spinning and doubling machinery.* Patent dated September 13, 1849.

These improvements consist in several mechanical arrangements for actuating the delivery rollers, spindles, &c., and effecting the various motions in certain mules and doubling machines of a peculiar construction, which were specified under two former patents granted to Mr. Potter in 1831 and 1842.

ROBERT GRIFFITHS, Havre, engineer. *For improvements in steam engines and in propelling vessels.* Patent dated September 13, 1849.

The patentee describes and claims:

1. The application of a sun and planet wheel gearing to the main shaft of a propeller, for the purpose of increasing its speed.

2. The application of two or more air-pumps to boat engines, for the purpose of equalizing and regulating their motion.

3. The use of an apparatus for indicating the force of the currents of water at different parts of the stern of a vessel, in order that the propeller may be adapted to the

lines of the vessel. This apparatus consists of a number of spheres made fast to transverse rods attached to the bottom of vertical rods, which are made fast at top to other transverse rods connected to balance springs on deck.

4. A self-regulating pitch propeller, which consists of a hollow sphere on the boss, into which the ends of the blades fit loosely. These blades are attached to levers, the free ends whereof bear against arms fixed in a collar, sliding on the main shaft, which bears against a lever, connected to a spring placed inside the vessel, and capable of adjustment. By this arrangement the speed of the vessel itself will determine the pitch of the blades, inasmuch as when the resistance offered to them is great, their pitch will be diminished in proportion to the resiliency of the spring, which, through the intervention of the lever, resists the sliding back of the collar along the shaft (the arms fixed to the collar bearing against the ends of levers attached to the blades), and thereby counteracts the inclination of the blades to assume, under increased pressure, a position at right angles to the shaft.

APOLEON PIERRE PRETERRE, Havre, France. *For improvements in the construction of coffee and tea pots, and in apparatus for cooking, and in apparatus for grinding and roasting coffee.* Patent dated September 13, 1849.

EDME AUGUSTIN CHAMROY, Rue du Faubourg St. Martin, Paris. *For a new system of railway, denominated (helicoid) helical railway, and a circular chariot.* Patent dated September 13, 1849.

[Particulars of the two last patents in our next.]

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Irving Hill, of Clapham, Surrey, gentleman, for certain improvements in the treatment of copper and other ores, and obtaining products therefrom. March 9; six months.

Richard Holdsworth, of the firm of Holdsworth and Co., cotton spinners, and William Holgate, engineer, for improvements in apparatus and machinery for warping worsted, cotton, and other fibrous materials. March 11; six months.

William Crane Wilkins, of Long acre, Middlesex, engineer, for certain improvements in ventilating, heating, and lighting, in lamps and candlesticks, in the manufacture of candles, and in the apparatus to be used for such purposes. March 11; six months.

James Nasmyth, of Lille, France, engineer, for improvements in the method of obtaining and applying heat. March 12; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| March 7 | 2219 | Joseph Gardner | Birmingham | Invalids' supporter, or bed-rest. |
| 11 | 2220 | Samuel Sharp & Co. | Vauxhall | An implement for distributing and sowing seed, and for a strickle or tool for regulating the quantity of seed in the said implement. |
| ,, | 2221 | Deane, Dray, & Deane, | King William-street | Railway break. |
| 12 | 2222 | Thomas Waddington | Manchester | A self-adjusting clip for gaiters and leggings. |
| ,, | 2223 | Richard Harris and Sons | Leicester | A polka. |
| ,, | 2224 | Thomas John Marshall | Bishopsgate-street Without | Dandy roller for letter and note paper. |

## NOTICES TO CORRESPONDENTS.

E. W. W.—*No. Drawings or prints are received.*

*Erratum.*—In Mr. de Chesnel's Description of Dujardin's Telegraph, p. 184, line 18 from the bottom, for "90 words a minute," read "90 *letters*."

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

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## MESSRS. PEACE AND EVANS'S PATENT PISTON AND EXPANSION JOINT.

Fig. 4. Fig. 2.

Fig. 3 Fig. 1.

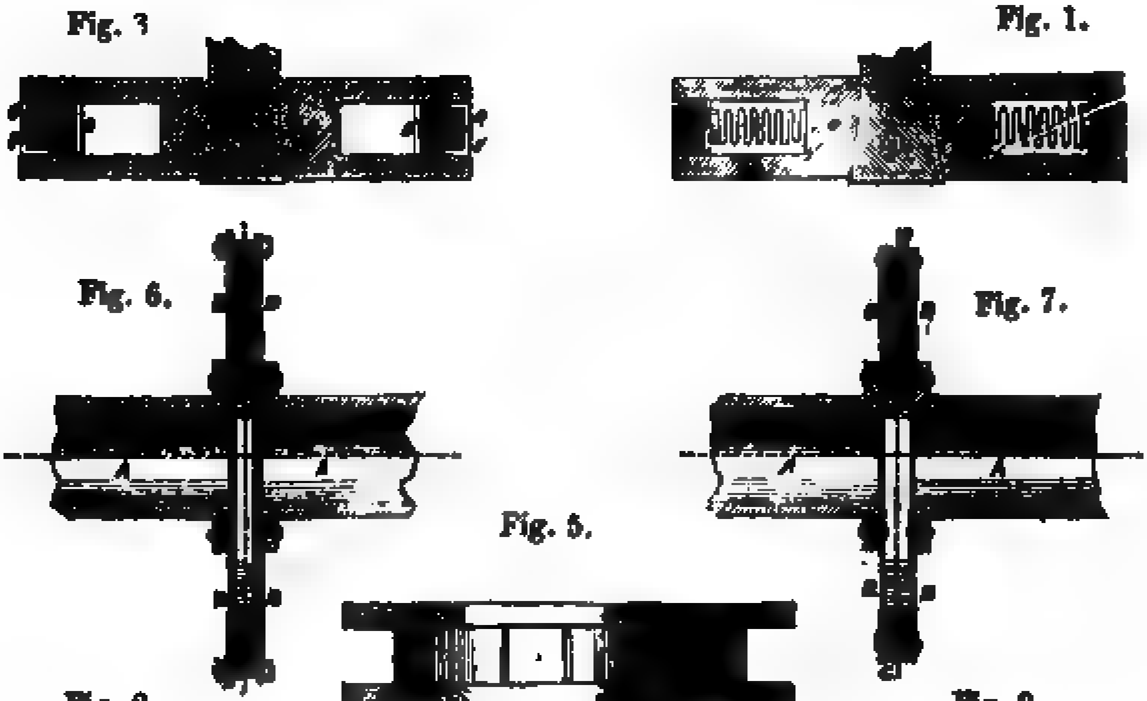

Fig. 6. Fig. 7.

Fig. 5.

Fig. 8. Fig. 9.

## MESSRS. PEACE AND EVANS'S PATENT PISTON AND EXPANSION JOINT.

[Patent dated September 20, 1849. Specification enrolled March 20, 1850. Patentees, Messrs. William Peace and Edward Evans, Engineers, Haigh near Wigan.]

### *Patent Piston.*

FIRSTLY, this invention has relation to the pistons of steam engines, and has for its object to supersede the necessity of employing bolts and nuts in the construction thereof, as usual, the loosening and breakage of such bolts and nuts having frequently been the means of causing great loss, expense, and delay in repairs. The upper and lower parts of this piston are made in one solid piece of metal, with a recess to admit of suitable packing, whereby the joint or part in contact with the side of the cylinder may be made tight. Fig. 1 is a vertical section of a piston thus constructed, with its rod: *a, a, a, a* represent the body of the piston, the upper and lower parts being in one piece; *g* is the lower part of the piston rod; *c, c, c, c* are the outward metallic packing rings, which are kept close to the cylinder, and also close to the upper and lower parts of the recess in which they are placed, by a spring of steel or other metal acting on the back of them, as is customary. The packing rings *c, c, c, c* are made level on the surfaces which come in contact with each other, as shown in the engraving, fig. 1; and the ring which presents the largest base inwards, and against which the back spring acts, must be made either rather thinner, as at $c^1$, so that it shall not touch the cylinder side, or it may be made of softer material than the other ring, so as to wear away faster; the object of both plans being that the softer or narrower ring may always be pressing, by the bevel part, both upwards and downwards, as well as horizontally, and thus keep the upper and lower surfaces of the recess tight at the same time that the joint to the cylinder side is also kept tight. Fig. 2 is a horizontal section through the centre of the piston, showing the mode of construction when the above arrangement is adopted: *f, f, f* are cells or hollows in the body of the piston, made for the sake only of diminishing the weight; *c c* the outer packing rings; and *b b* springs acting against the back of the packing rings. The springs are represented as being spiral, but any other kind of spring may be substituted.

Instead of the springs and rings above described, a ring of vulcanized Indian-rubber, or other elastic material, may be used, as shown at *d* in fig. 3. In this case the upper and lower parts of the recess will be kept tight by the elasticity of the packing behind, whilst at the same time the packing rings, *c c*, will be kept close to the side of the cylinder. Fig. 4 is a horizontal section through the centre of the piston, showing the hollows or cells *f, f, f; e e* is a metallic ring, which is inserted round and against the edges or divisions of the cells, to prevent the elastic packing *d* from getting into them, and also for the packing to act against. Fig. 5 is a skeleton view of the piston without the packing rings, intended merely to show the cells and the divisions therein.

### *Expansion Valve.*

*Secondly.* This invention consists of an elastic or expansion joint for the pipes of steam engines and boilers, pumps and air-vessels, which joint is so constructed as to admit of the expansion and contraction consequent on the variations of temperature to which they may be exposed, as also to relieve the extreme pressure and sudden shocks attending the alternating action of pumps, and so to prevent fracture of the pipes or joints. The joint is formed, as shown in the vertical section, fig. 6, and end elevation, fig. 8, of two wrought iron circular plates B B, riveted or otherwise attached to the cast-iron flanches of the steam, air, or water pipes A A, and which form, when thus attached, wrought-iron extensions of the cast-iron flanches. The plates are also fastened together at the outside edges, so as to be perfectly tight, by inserting between them a metal ring C, with a vulcanized Indian-rubber washer on each side of it, and bolts and nuts holding the two plates together against these washers and the ring. Or, the plates may be made tight at the outer rim by inserting a perforated ring of metal between them, and riveting the whole together, as represented in the vertical section, fig. 7, and end elevation, fig. 9, the rivets being passed both through the plates and the ring. It will be observed that in both modes of fastenings the outer ring keeps the flanches of the pipes and the rivets therein far enough apart to admit

of the elongation of the pipe, without bringing the ends of the cast-iron pipes in contact with each other; the elasticity of the wrought-iron plates admitting of such variation in the length without fracturing the pipes or breaking the joints.

*Claims.*

*First.* Making the pistons of steam engines, both top and bottom, in one solid piece, having a recess for the packing, and the adaptation thereto of packing rings of the peculiar form and construction before described.

*Second.* The elastic or expansion joint, for steam-engine boiler and other pipes, formed of wrought-iron plates attached to the flanches of the pipes, as before described.

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ELECTRIC TELEGRAPHS.—REPLY OF MR. BAKEWELL TO MR. BAIN.

Sir,—I am obliged again to claim room for reply to Mr. Bain's misrepresentations respecting my Copying Telegraph, and to notice the equivocations with which he evades the points I allude to in my former communication.

Mr. Bain asserts, that my copying telegraph is an imitation of his invention patented in 1843, and he attempts to prove the assertion by a few simple interrogatories. Without objecting to this curious mode of proof, it appears that what Mr. Bain wishes to establish by his five interrogatories is, that in all copying or printing telegraphs, synchronous movements of the distant corresponding instruments, are essential to the correctness of their action; that the means of attaining that object are shown in his specification of 1843; and that I have adopted those means in my invention. To dispose of these questions, it might be sufficient to state the undisputed fact, that the professed object was not accomplished by the arrangements specified. The plan described by Mr. Bain for copying types is, indeed, altogether impracticable, and I challenge him to state whether he has ever obtained a single line of legible words by that means. Synchronous step-by-step movements, caused by electro-magnets, had been accomplished before Mr. Bain's invention, but the attainment of synchronous continuous motion in separate rapidly-moving instruments, was, I believe, never accomplished before my invention. In confirmation of this I may state, that when I exhibited my instruments to the Managing Director of the Electric Telegraph Company, he said, I had accomplished what the most eminent scientific men had declared to be impossible.

Mr. Bain invites your readers to visit the Enrolment-office to inspect his specification of 1843, well knowing that scarcely any one would take that trouble. Let him publish that part of the specification relating to the telegraph, and then it will be seen by all whether any of the original arrangements are retained in "the *patent* copying telegraph in its improved state," and whether I have adopted any one of those mechanical arrangements; all of which have, indeed, been abandoned by their author as useless. I this day inspected the specification again, and have had my former impression confirmed, that the invention only refers to the copying of types, and that Mr. Bain had then no idea of the means of copying writing. The following extracts clearly show this to have been the extent of his proposed means of communication:

"Sheet 6 shows the arrangement for taking copies of surfaces, *for instance, the surface of printer's types*, at distant places."—"When a communication is to be sent, I proceed in the following manner: *I first set up the types of which the communication is composed* in a metal frame in the usual manner." Again: "The operator *having set up the types*," &c. In several other places the types are spoken of as the only means of effecting a communication, and not a word about transmitting copies of writing.

Mr. Bain lays much stress on the employment of pendulums, which make and break the electric current; but he can scarcely claim the invention of pendulums; and the objects for which I employ them are very different from those indicated in his arrangements. He seems also to make a great point of having

used "a train of four wheels," which I mentioned to have been the number sufficient for the mechanism of my telegraph. Unless Mr. Bain claims to monopolise all trains of four wheels, for whatever purpose employed, this cavelling is perfectly childish. The trains of four wheels shown in his specification, have for their sole use the lowering gradually of the flat surfaces to which the frames of types and the receiving paper are fixed. In my telegraph nothing of the kind is to be found, for no such purpose is requisite; as the written message transmitted and the receiving paper are attached to rotating cylinders fixed on their axes.

Mr. Bain refers to his specification for the "guide line," which forms one of the claims in the specification of my patent. I looked for it carefully; but it was nowhere to be found.

To return to the charge of breach of confidence. I defy Mr. Bain to point out, in any part of my invention, a single arrangement or adaptation derived from him that was not open to the whole world. A breach of confidence, indeed, there has been, and a flagrant one too. Mr. Bain having lured from me, by promise of present reward and future advantages, the mode by which I proposed to copy writing, in the form exhibited in a specimen I showed him, he immediately retracts the offer, sets to work to accomplish the object by the means I had pointed out; but not having succeeded till after my patent was sealed and specified, he now, in order to screen himself, raises the cry, "Breach of confidence!" Mark the evasion about the promise of reward for the disclosure of my plan! He does not positively deny that he offered me 500*l*., but says that my mention of it is dishonourable! Dishonourable to whom? He admits having offered "a sum of money,"—why object to acknowledge the amount? Does he think 500*l*. too large a sum for the accomplishment of an impossibility—which he states *he knew* it to be. Here is an indirect admission of the disclosure he denies. His letter abounds in contradictions. He says it is dishonourable to state that he offered 500*l*. for the disclosure of my plan, yet he owns to the offer of "a sum of money." He denies that I made any disclosure, yet he says he knew that what I professed to do was impossible; and in the succeeding paragraph he denies that he said it was impossible, for he had already done it!

Nothing can be more preposterous than Mr. Bain's claim to include his present arrangement for copying writing within his patent for copying types. The objects to be accomplished are not the same, and the arrangements for effecting them are entirely different. The two plans agree only in one particular—their impracticability. Without going some steps closer to the arrangements described in the specification of my patent, there can be no certainty in the action of such instruments as Mr. Bain described. Occasionally, legible writing may be obtained; but, whenever the instruments require regulation by the governing pendulum, as they continually must do, the force of the controlling check will disturb the action of the pendulum, and the result will be a confusion of marks, instead of legible letters. If a patentee were allowed to appropriate the inventions of others by including them in a patent specified years before, there would be no protection to inventors whatever; yet such is Mr. Bain's notion of the expansive monopoly of his patent of 1843.

I must crave a little more space for a notice of Mr. Baddeley, who, from some cause not apparent, has volunteered his opinion of what he calls my "defence." That opinion may pass for what it is worth with those who know Mr. Baddeley; but I feel confident that the nearly unanimous judgment of all impartial men will be, that his opinion is as wrong as it is coarsely expressed. If Mr. Baddeley had not been blinded by his zeal as a partizan, he would have seen my statement, that I had disclosed to Mr. Bain, before the date of my patent, the plan of copying writing in the form he now adopts. The date of that communication was, therefore, all-important to form an opinion who was the inventor, and to whom the charge of infringement attaches. My disclosure to Mr. Bain was made on the 13th October, 1847. On the following day, suspecting foul play, I deposited the sealed paper containing a statement of the disclosure, with the offer which induced me to make it, together with a specimen of the form of the telegraphic writing. Having—early in the year 1828—succeeded in

copying writing on separate instruments, on the 15th of April, 1848, I entered into a conditional agreement with the Electric Telegraph Company for the adoption of my invention, and on the 18th of the same month, the instruments were exhibited to the Managing Director of that Company, of which Mr. Bain was a shareholder, and, I bel eve, a director. Let Mr. Baddeley mention the date when he saw "Mr. Bain operating with copying telegraphs in all respects identical with that described in No. 1383 of your Magazine." I am, Sir, yours, &c.,

F. C. BAKEWELL.

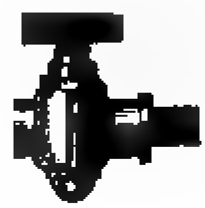
Hampstead, March 11, 1850.

P.S. It was stated in a recent Number of your Magazine, that Mr. Baddeley had been exhibiting Mr. Bain's telegraphic inventions to several scientific gentlemen in Paris. I am curious to know, whether even at that time Mr. Bain's Copying Telegraph was exhibited by Mr. Baddeley, or whether it has been completed since.

## WILLWAY'S PHERO-PNEUMA, OR GAS-CARRIER.

(Registered under the Act for Protection of Articles of Utility. John Sweet Willway, of Denmark-street, Bristol, Mathematical Instrument-maker, Proprietor.)

Fig. 2. Fig. 3. Fig. 1.



Figs. 1 and 2 are a front and side elevation of this apparatus, which is intended to facilitate the shifting of the light or gas-burner from one place to another, while the gas is burning. A A is a frame, which is built or fixed into a space in the ceiling of the apartment. B is a reel or pulley, which runs upon an axis fixed to the frame A. C is the supply pipe, by which gas is conveyed from the main or meter; it is connected with a bent pipe D, affixed on the face of the pulley by a piece of flexible pipe E. F is a length of pipe of vulcanized Indian-rubber or other flexible material, which is coiled several times round the pulley, and is affixed at one end by the bent pipe D; the other end, after passing down through the ceiling, terminates in a tap, which, when the light is to be used, is connected to the burner by a bayonet-joint G, having an inclined groove *a*, as shown separately, on an enlarged scale, in fig. 3. When the light is to be removed to any other more distant place, the unwinding of the flexible pipe from the reel B admits of its being done, while at the same time the flexible pipe E permits the reel to turn freely round without stopping off the supply of gas. The reel B is furnished with a small spiral spring H (shown in dotted lines), one end of which is fixed to the pulley, and the other end to the axis. The action of the spring is such that it causes the pulley to turn round and wind up the flexible pipe F, when it is slackened by bringing the gas lamp or burner nearer to the pulley.

## NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Resumed from vol. xlix., p. 11.)

### *Third and Concluding Series.*

### I.—SYMMETRIC PRODUCTS.

1. It may be as well to state that the First Series of these Notes was published in the forty-sixth volume of the *Mechanics' Magazine*. The Second Series, commenced in the forty-eighth, was concluded in the forty-ninth volume of that work. In the same columns the writer hopes to find a place for this, the concluding Series of his Notes on the Theory of Algebraic Equations.

One general remark I may perhaps be permitted to make before entering into details. I wish to intimate my opinion that, in the whole range of pure science, there is, perhaps, no department which affords greater opportunity for exertion, which presents more room for improvement, or which will, in the course of a few years, be more thoroughly revolutionized, than the *algebraic* theory of equations. It would be most unwarrantable to assert that that subject is in its earliest stage. The mighty names and labours, the immortal works and historical associations connected with it, forbid that; but, at the same time, it is permissible to observe, so rapid has the course of improvement been within the last few years, that there is, perhaps, no subject of which the present state is more imperfectly represented by the text-books than the Theory of Algebraic Equations. This imperfection is the result of the comparatively recent period at which some of the most important steps have been made, and the mention of it consequently involves no disparagement of the authors of those valuable works.

Among some of the more recent and conspicuous improvements, in the theory, must be placed the researches* of Mr. G. B. JERRARD. He has put in a new point of view the application to it of *indeterminate* methods, and, by an admirable notation, has given us great command over *symmetric functions*.

2. It was in the first of five papers "On the Transformation of Algebraic Equations," published in the *Mathematician*,* that I originally considered the subject of this article,—the METHOD OF SYMMETRIC PRODUCTS. It was not, however, until subsequently that I gave to the method the name here employed to designate it. The following references indicate those portions of the five papers on Transformation which relate to the Method of Symmetric Products, viz.:—*Mathematician*, vol. I., pp. 82-84; pp. 113-4, arts. 1 and 2†; pp. 194-5, arts. 1, 2, 3, 4, and 5; and pp. 297-9, arts 1 to 8: and vol. III., pp. 178-9. The last-mentioned two pages contain my fifth paper on Transformation, which consists of a brief analysis of the previous papers on the same subject, together with some additional remarks on the Method of Symmetric Products.

3. I have also discussed this method in the *Philosophical Magazine*. The reader is referred to my "Outline of a New and General Mode of Transforming and Resolving Algebraic Equations," at pp. 383-4 of vol. xxvi. of the present (3rd) series of that work for the details. In the second paragraph of art. 3 of the last-mentioned page, and in the "Errata and Addenda" to the volume which contains it,‡ will be found materials for correcting an oversight which I committed in my first paper on Transformation, at pp. 82-4 of vol. I. of the *Mathematician*, the second paragraph of which ought to be amended so as to render the functions, $\phi$, there used, identical with the special forms of $\phi$ adverted to in the second paragraph of art. 3 of my "Outline."

4. In the succeeding (27th) volume of the same (3rd) series of the *Philosophical Magazine*, there will be found, in papers by me, two articles which must be read in connection with the "Outline"§ above mentioned; viz., art 4 of p. 127, and art. 7 of pp. 293-4.

* See his *Mathematical Researches*.

* The first Number of this work bears date November, 1843. The first volume was edited by DAVIES, RUTHERFORD, and FENWICK; the second and third have been conducted by the two last-named mathematicians alone.

† And see a remark (in art. 9). *Ib.* p. 116.

‡ See *Phil. Mag.*, p. viii. of "Contents of vol. xxvi.—Third Series."

§ I observe that, in the 5th and 6th arts.* of the

* *Phil. Mag.*, S. iii., vol. xxvi., p. 384.

5. It was at p. 405 of vol. xliv. of the *Mechanics' Magazine*, that I first used the term "Symmetrical Products" in connection with the method under discussion. With the exception, however, of a remark* at the succeeding page (406) of that volume, and of another observation at p. 36 of the next (45th) volume, I did not further prosecute the subject in this work until the publication of the First Series of these Notes, in which (see *Mech. Mag.*, vol. xlvi., pp. 492 and 517) I resumed the discussion. Except in a short paragraph, at p. 538 of vol. xlviii. of the *Mechanics' Magazine*, the subject of the Method of Symmetric Products did not form part of the Second Series of these papers.

6. Not altogether unconnected with the development of the method, is a question which I proposed in the *Lady's and Gentleman's Diary* for 1846 (which was answered in the *Diary* for 1847), and on which I commented at pp. 84-86 of the *Diary* for 1848.

7. This appears to be the proper place to point out the *limits* of the application of the method—at least, in considering it from the point of view which has, for the most part, been taken in the foregoing observations.

Let X, Y, Z, &c., be, each of them, linear and homogeneous functions of $n$ quantities $x$, $y$, $z$, $u$, &c., and of the form

$$x+ay+bz+cu+\&c.,$$

and let the last expression be supposed to be essentially unsymmetric with respect to $x$, $y$, &c.; that is to say, suppose that some one at least of the quantities $a$, $b$, $c$, &c., is different from unity. Then, when $n=3$, the product X Y may be rendered symmetric, and, when $n=4$, the product XYZ may be so rendered. But, when $n$ is greater than 4, no symmetric product can be formed whose dimensions with respect to $x$, &c., are so low as $n-1$.

This is the simplest aspect of the method, and, perhaps, the only one under which we shall find it necessary to consider it here.

8. It may, nevertheless, be readily proved that, whenever the product

$$\mathrm{X\,Y\,Z}\ldots.$$

is symmetric, then the expression

$$\mathrm{X'YZ}\ldots+\mathrm{XY'Z}\ldots+\mathrm{XYZ'}\ldots+\&c.,$$

(where X′, Y′, Z′ are respectively the same functions of $x^m$, $y^m$, $z^m$, &c., that X, Y, Z, &c., are of $x$, $y$, $z$, &c.,) is also symmetric with respect to $x$, $y$, $z$, &c.

For, let $p$ denote any of the quantities $x$, $y$,.., indifferently; let $q$ denote the same thing; as also $r$, &c., then for any term

$$(ep)\,(fq)\,(gr)\ldots\ldots\ldots\ldots$$

in the expression for XYZ.. we shall have, in the expression for X′YZ..+ &c., the corresponding term

$$(ep^m)\,(fq)\,(gr)\ldots+(ep)\,(fq^m)\,(gr)\ldots+\&c$$

which is symmetric with respect to $p$, $q$, $r$,., and, consequently, with respect to $x$, $y$, $z$,.,.; hence, if the first expression (XYZ..) in the present article be a symmetric function of $x$, $y$, $z$,.,. the second will be so likewise.

This reasoning may be so pursued as to enable us to arrive at the more extended class of propositions which I have alluded to at art. 7 of p. 293 of vol. xxvii. of the *Philosophical Magazine* (S. iii.). But it is sufficient merely to mention the fact, without entering into details which the reader will readily conceive for himself. Nor shall I make any further remarks on the method in

"Outline," there is considerable vagueness and obscurity. In the first place, the M which occurs in the second line of art. 5, should be accented—in fact, changed to M′. Again; the $y$ which occurs in the same line must be considered, not as *determined* by the operations of art. 3, but as having the undetermined form which is given to it in the second line of that article. In this case, the right-hand side of the equation in line 2 of art. 5, will, in the case of biquadratics, involve not more than four* undetermined quantities, whatever be the values of $\lambda'$ and $\mu'$. The same observations apply to art. 6 of the "Outline," the number of undetermined quantities being, however, greater as the given equation advances in degree.

In the case of art. 5 of the "Outline," the number of disposable quantities will, in fact, be less than four, or, what amounts to the same thing, the number of disposable ratios will be less than three. And we have not even a *primâ facie* reduction of a biquadratic to the binomial form,† much less of an equation of the fifth degree to the form of De Moivre. Nor does art. 6 enable us to take away $r$ terms of the root of an equation. Arts. 5 and 6 of the "Outline" may therefore be expunged. The true development of the Method of Symmetric Products would seem to lie rather in the addition of terms to the right-hand side of the equation (3) of art. 3, as suggested at art. 7, p. 293 of vol. xxvii. of the *Phil. Mag.* (Ser. iii.)

* This remark forms the germ of the concluding paragraph of my fifth paper on Transformation, at p. 179 of vol. iii. of the *Mathematician*.

* See the Sixth *Report of the British Association*, pp. 301, *et seq.* art. [4.]

† A *primâ facie* but illusory transformation of this kind has been given by me at pp. 132-3 of vol. xxviii. of Ser. iii. of the *Phil. Mag.*, by the aid of three disposable ratios; but with less than three, I am not aware of any *primâ facie* solution even.

its general scope, but shall proceed to consider its application to the case of

CUBIC EQUATIONS:*

If, besides the known relations between the coefficients and roots of a cubic, we have also the relation

$$x + ay + bz = 0,$$

where $x$, $y$, $z$, are the roots, and $a$ and $b$ any undetermined quantities, the roots of the cubic may be readily determined by elimination (*Mech. Mag.*, vol. xlvi., p. 492). Now, if we can determine $a$, and $b$, and two new quantities, $c$ and $d$, in such manner as to render the product

$$(x + ay + bz)\ (x + cy + dz)$$

symmetric with respect to $x$, $y$, and $z$, it will always be possible to reduce a given cubic to another between whose roots the required relation shall exist. For, if $x'$, $y'$, $z'$ be the roots of a given cubic, and if †

$$x = \beta x' + x'^2,$$

and the same relation be supposed to exist between $y$ and $y'$, and $z$ and $z'$, $\beta$ may be so determined as to render that product, (which we may call XY, and which will, from what I have already observed, be a symmetric function of $x'$, $y'$, and $z'$,) equal to zero. Whence we infer that

$$X = 0, \text{ or } Y = 0.$$

By developing, we find that

$$\left.\begin{array}{l} XY = x^2 + acy^2 + bdz^2 + (a + c)xy \\ \quad + (b + d)xz + (ad + bc)yz \end{array}\right\}$$

and, in order that XY may be symmetric, we have

$$\left.\begin{array}{l} 1 = ac = bd \\ a + c = b + d = ad + bc \end{array}\right\} \cdot\cdot\ (a).$$

Let

$$A^2 - (a + c)A + 1 = 0$$

and $$B^2 - (b + d)B + 1 = 0$$

then, from the equations immediately preceding the last two, we perceive that the values of A are $a$ and $c$, and those of B are $b$ and $d$, and, since $a + c = b + d$, the values of A and B are identical, that is to say—

$$a = c,\ b = d$$

or

$$a = d,\ b = c;$$

but, the first system gives, on combining it with the previous conditions,

$$a = b = c = d = 1,$$

a case excluded by the spirit of the Method of Symmetric Products; hence we take the latter system and, thence, eliminate $b$ and $d$ from the system $(a)$; the result is

$$1 = ac;\ a + c = a^2 + c^2:$$

and, from these last equations, we obtain

$$\begin{aligned}(a + c)^2 &= (a^2 + c^2)\,(a + c), \\ &= a^3 + c^3 + ac(a + c), \\ &= a^3 + c^3 + a^2 + c^2, \\ &= a^3 + c^3 + (a + c)^2 - 2,\end{aligned}$$

or, $a^3 + c^3 = 2$.

Hence the equation, whose roots are $a^3$ and $c^3$, is

$$C^2 - 2C + 1 = (C - 1)^2 = 0,$$

and, consequently $a^3 = c^3 = 1$.

For reasons already assigned, we reject the values $a = c = 1$; hence, $a$ is one of the *unreal* cube roots of unity, and the relation

$$c = \frac{1}{a}$$

enables us to see that $c$ is the other. Let $a$ and $a^2$ be these unreal roots, then the product

$$(x + ay + a^2z)\ (x + a^2y + az),$$

or XY, is symmetric with respect to $x$, $y$, and $z$.

Express $x$, $y$, $z$ in terms of $\beta$, $x'$, $y'$, $z'$; then $XY = 0$ is a quadratic in $\beta$, and, $\beta$ being determined, we may assume $X = 0$ or $Y = 0$, and determine $x$, $y$, and $z$ by elimination, and $x'$, $y'$, $z'$ from these latter quantities either by the method pointed out in the note at pp. 27—9 of JERRARD's *Mathematical Researches*, or by that pursued at pp. 401—4 of Prof. J. R. YOUNG's *Theory of Equations* (2nd ed., 1843.)

But, as I have noticed at p. 84 of vol. i. of the *Mathematician*,* and at art. 6 of p. 133 of vol. xxviii. of the *Philosophical Magazine* (S. iii.), the Method of Symmetric Products may be applied, under a different form, to the solution of cubics. And the latter form will have

* For some remarks on the solution of quadratics by means *analogous* to that of the Method of Symmetric Products, see *Mathematician*, vol. i., p. 83, and *Phil. Mag.* s. iii., vol. xxvi , p. 384, and vol. xxvii., p. 127.

† The equation which follows is adopted instead of the assumption

$$x = \beta + x'$$

in order to avoid *critical* functions (as to which see *Mech. Mag.* vol. 46, p. 517, &c.)

* And see the observation at the end of art. 5 of p. 195 of that volume.

the advantage, inasmuch as critical functions do not occur in it.

Let

$$\frac{1}{\beta + x'} = f(x'),$$

and make

$$x = f(x'),\ y = f(y'),\ z = f(z');$$

then, in the present case, we shall have, on reduction,

$$XY = 0 = \frac{L\beta^2 + M\beta + N}{\beta^3 + \&c\ldots},$$

and the required relation will be satisfied if we make the numerator of the last expression vanish. This may be done by means of a quadratic in $\beta$; in fact, if the given cubic be denoted by

$$x'^3 + a'x'^2 + b'x' + c' = 0,$$

the coefficients of the above quadratic in $\beta$ will have the following values;—

$$L = \Sigma x'^2 - \Sigma x'y' = a'^2 - 3b',$$
$$M = 6x'y'z' - \Sigma x'^2 y' = a'b' - 9c',$$
$$N = \Sigma x'^2 y'^2 - \Sigma x'^2 y'z' = b'^2 - 3a'c'.$$

To the above solution by the Method of Symmetric Products there corresponds a *direct** solution which I discovered some years before that above discussed, and which will be found in vol. ii. of the *Cambridge Mathematical Journal*. I subjoin in a note† some references to this solution, and to observations of mine upon it, and, in concluding this paper, I think I may venture to say that the solution is singularly happy in its *arithmetical and practical* results, —results which I hope to display in the next of this series of papers.

JAMES COCKLE.

2, Pump-court, Temple, February 9, 1850.

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* *Phil. Mag.*, s. iii., vol. xxxii., p. 355.

Let me add here, too, that the methods pursued in the Theory of Equations may be conveniently divided into *direct* and *indirect*, the latter denoting those, the operation of which depends on a knowledge of the number of the roots of an equation, the structure of the coefficients, &c.

† "New Solution of a Cubic Equation." *Cambridge Mathematical Journal*, vol. ii., pp. 248—249.

"Note on a Solution of a Cubic Equation." *Camb. Math. Jour.*, vol. iii., pp. 28—29.

"Note on the Theory of the Solutions of Cubic and Biquadratic Equations." *Ibid.* pp. 104 *et seq.*

(And see "Mathematical Notes" at pp. 285—286 of vol. i. of the *Camb. and Dublin Math. Jour.*, and the *Postscript* at p. 273 of vol. ii. of the *Camb. and Dublin Math. Jour.*)

"On a Solution of a Cubic Equation." *Ibid.* vol. iv., pp. 95—6.

And, in addition to the places just cited, see arts. 6, 7, and 8 of pp. 195—7 of vol. i. of the *Mathematician*, and p. 179 of vol. xlvi. of the *Mech. Mag.*

## ON THE CAUSES OF THE EXPLOSION OF STEAM BOILERS AND OF SOME NEWLY-DISCOVERED PROPERTIES OF HEAT. BY MR. JAMES FROST, OF BROOKLYN, NEW YORK.

(Continued from page 194.)

The present diagram represents a bent glass tube, sealed at the shorter end, a manometer or eudiometer, a very small drop of water having been first introduced into the shorter sealed end thereof, that end was filled with mercury, and such a certain small portion also of the longer end (the exact quantity to be given hereafter). This eudiometer having a wooden handle, a cork float and index wire, covered with thread, introduced therein, was prepared for experiment.

The shorter end of the eudiometer was immersed in a vessel of cold water, the vessel placed over a fire, and when the water boiled, small quantities of common salt were added at intervals, while the water was boiling, and until it was saturated and maintained the stationary heat of 228° for a few minutes, whereby the greater part of water being superfluous, was expelled with the mercury from the shorter to the longer end of the tube without disturbance, and a full volume of pure steam, rarefied and expanded by the heat of 228°, was retained in and filled the shorter end of the tube, while the greatest height of the index wire was marked on the wooden handle.

To estimate rightly the actual extent and value of the expansion of a definite volume of steam in this eudiometer, it becomes necessary; first, to define, obtain, and fix upon some well known and definite unit of steam, and a volume of steam will be formed under atmospheric pressure and temperature 212°, which will faithfully represent a full and definite unit volume of atmospheric steam in the eudiometer, provided that, at the time of observation, the surface of the mercury in the shorter end of tube stands on a level with the mercury in the longer end of tube, both ends being immersed at the time in boiling water. This adjustment may be very conveniently and accurately obtained by employing a double boiler or Balneum Maria, the outer vessel of metal containing the boiling salt water, and an inner vessel of glass connected to a metallic bottom. Such a glass cylinder should be of much less diameter, but of twice the height of the outer metallic vessel, and filled with water, which will be maintained at the boiling temperature of 212°, by the greater heat of the saline solution at 228° in the outer vessel.

For in this transparent boiler and liquid, the quantity of mercury in the respective

ends of the tube may be seen, the instrument may be withdrawn therefrom for adjustment, and very nicely adjusted and replaced. The index shows the different volumes of steam in the eudiometer due to the different temperatures of 212° and 228°, which being marked on the wooden handle, the intermediate volume at 216° may be readily obtained by a subsequent addition of such small quantities of salt to the fresh water bath, as will secure a fixed boiling temperature of 216° therein.

That diagram exhibits the unit of atmospheric steam accurately, and its apparent or visible increased expansion by heat, but not the real expansion, which being greater than the apparent, has still to be obtained by calculation and by increasing the apparent in proportion to the increased densities of the steam, according to the well-known law of Mariotte, "that the volumes of all elastic fluids at the same temperatures are proportioned to their densities," and when that proper allowance has been made, the absolute expansion in the eudiometer will be found to correspond very nearly indeed with our previous general statement.

Having thus plainly shown the volume and rate of expansion of atmospheric steam, or of "low steam," when heated out of contact with water to 216° or to 228°, we will next show the rate of expansion of a unit of "high steam," or steam formed under pressure at 228°, when heated to 650 out of contact with water, by means of a definite unit of steam produced under greater pressure than the atmosphere, by a mercurial column contained within the doubly bent glass eudiometer, which at first is open at both ends, as represented in fig. 2. This instrument was prepared for experiment in the following manner. A small drop of water having being introduced within the upper doubly bent part, the instrument was filled with mercury to the level of the small taper and open end, and was then immersed (to nearly the level of the mercury within the instrument), into a vessel of cold water placed over a fire till the water boiled, when small quantities of salt being added at intervals till the water was saturated, and maintained the stationary heat of 228° for a quarter of an hour.

By this means, all the superfluous water and steam was gradually expelled from the doubly bent part of the tube, through and from the small open end, while the doubly bent part was filled with a volume of heated and rarefied steam, produced under a temperature of 228°, and under the pressure of the atmosphere = 30 inches + 5 inches mercury in the short tube, being a pressure equal to 35 inches mercury.

The eudiometer was then withdrawn from the saline bath, the steam condensed within the upper bent part and adhered to it. The instrument was then held in an inclined position, so that the included mercury filled the small taper end, and that end sealed with a blowpipe flame, the instrument was completed for experiment, by equalizing the height of mercury in both ends of the tube, by attaching a wood handle thereto, and in introducing a float and index wire within the longer open end of the instrument.

The experiment commenced by returning the instrument for a few minutes to saline bath heated to 228°, by which the definite volume of steam that had been obtained at that temperature was reproduced and defined by the index, and marked upon the handle. The second process consisted of transferring the eudiometer and thermometer to a mercurial bath. This apparatus was heated to 650°, withdrawn from fire, allowed to cool leisurely, by which ample time was gained for correctly marking the corresponding descent of the mercury in the instrument and thermometer, and marking the position of the index upon the handle, (though transferred to the glass tube in the diagram, for want of room on the page.)

Thus we show, by the aid of separate instruments, the nature and rate of expansion of steam, when heated in contact with mercury but out of contact with water, from 212° to 228°, and from 228° to 650°.

The next diagram represents an instrument in which is shown the nature and rate of expansion of steam, when heated in contact with mercury and out of contact with water, from 208° to 650°.

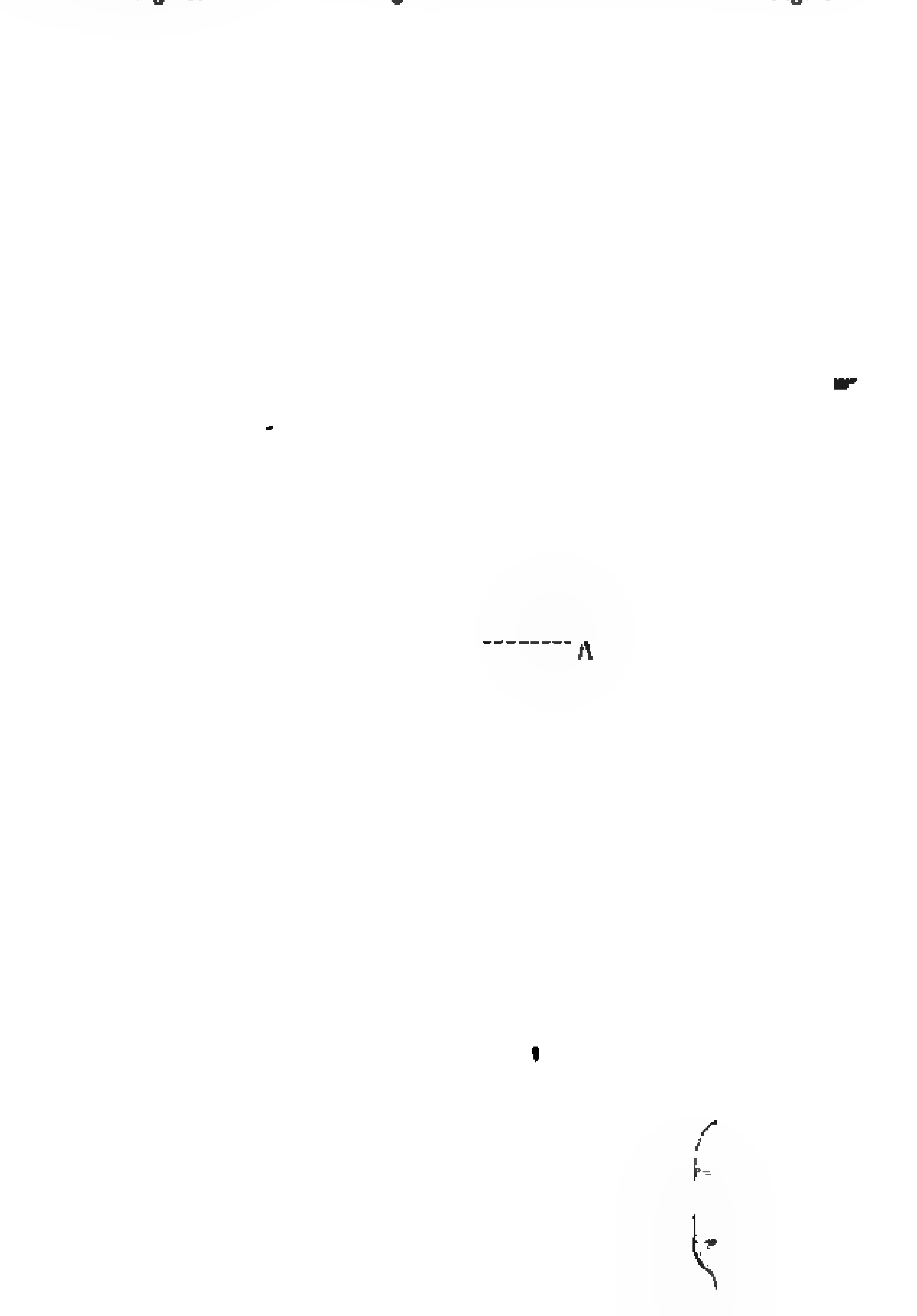
The experiment commenced by introducing a small drop of water to the cylindrical bulb of the instrument, and then filling that bulb and such a probable small portion of the long tube, as would cause the mercury to stand on a level in the bulb and long tube at 212°. The instrument being thus partially adjusted for experiment, was immersed along with a thermometer in a double mercurial bath, or balneum maria, of considerable magnitude, while the temperature thereof was gradually raised to 650° and maintained thereat some minutes, till the mercury was expelled from the cylindrical bulb, and all superfluous water and steam was expelled from the instrument.

The bath and included instruments being withdrawn from fire, were all alike allowed to cool spontaneously, which occupying more than an hour, afforded ample time for recording the corresponding descent of the mercury in both instruments, and which the diagram faithfully represents, as well as the calculated density of the steam

at various periods, while the level of the mercury in the bulb and tube having been equalized at the temperature of 212°, to obtain the comparative unit of atmospheric steam therein.

To be able to make, repeat, and estimate

Fig. 1. Fig. 2. Fig. 3.



correctly the advantage of these experiments, it will be necessary to become acquainted with several facts first observed during these labours: and first, that mer-

cury boils in a vacuum at about 570°, or ninety degrees below its boiling point under atmospheric pressure; and, therefore, as it boils thus early in a well made thermometer, the sealed end of the instrument must be unsealed to obtain the requisite range of temperature.

Having by the foregoing means ascertained the great extent of the expansion of steam, when heated out of contact with water from 208° to 650°, and under pressure varying from 28 to 42·75 inches mercury, our next effort was directed to discover, by some easy and obvious means, the actual quantities of heat in natural steam, and the relative quantities of heat or caloric in rarefied steam when heated to 650° under atmospheric pressure, in order to learn the actual cost of each, and determine the relative mercantile value and economy of either, by the comparative quantities of heat required for their respective production, the only truly rational mode of comparison.

This important information was easily and distinctly ascertained, and may be readily verified with little trouble or expense, by the use of a small and appropriate distilling apparatus. The one employed was connected by a small stop-cock with a high-pressure steam boiler, and the apparatus consisted of a small copper condenser, weighing three pounds, and having a superficial surface of two feet; it was placed at the bottom of a stout wooden covered cistern containing half a cubic foot of cold water at 50°. Then as much water was occasionally distilled (from natural steam of various densities and corresponding temperatures) as exactly filled a glass measure with a narrow neck, containing nearly a pound of water, the half cubic foot of cold water in the cistern was heated thereby from 50° to 82°; therefore, thirty-two degrees of heat had been separated from the measure of water obtained by distillation from natural or unheated steam. This exact quantity of heat, let it be particularly observed, was an invariable quantity, however various the temperature or density of the natural steam from which that constant measure of water was distilled; showing the curious and instructive fact, singularly needed long ago, yet hitherto unnamed and undefined by either chemical or philosophical writers, that *natural steam, however varying in density or temperature, is nevertheless one invariable atomic compound of water and caloric, and as definite as any chemical atomic compound whatever.*

This simple and wonderful fact, had it been as plainly disclosed long ago, would have saved the world from the monstrous delusions that have so long vexed it, and misleading such men as Wolfe, Perkins, and others, who conceited that great profit would accrue from employing very high steam for motive power; while the fact plainly appears that not a fraction of profit could thence alone possibly ensue, because the greater the tension of steam, the greater the proportional cost, the less the volume thereof. This notice may still be of use to any unfortunate who may still cherish any portion of the miserable delusion, by which, there can be no doubt, the rational improvement of the use of steam was thus irrationally and unnaturally hindered for many years.

Again; when a similar and exact measure of water was distilled by the same apparatus from steam heated to 650° out of contact with water, and in passing from the boiler to the condenser within and through a heated iron spiral tube, the cold water in the condensing cistern was heated from 50° to 88°, or 38° of heat was separated by distillation from the equal measure of water obtained from steam so subsequently heated to the temperature of 650°.

Thus then it is clearly shown, that the whole heat in common steam of atmospheric tension, of any or every temperature, is to the whole heat in steam of equal tension heated to 650° out of contact with water, is 32 : : 38; or, the caloric therein is only about one-sixth part greater in quantity in heated and such greatly rarefied and expanded steam, than in common or natural steam.

By examining the diagram No. 3, and scale annexed, it will be seen that a volume of atmospheric steam being heated to 650°, or 438°, has been thereby and therein expanded to more than seven volumes, while the density thereof is at the same time increased in the proportion of 30 : : 42·50 inches mercury; the actual increase, then, according to Mariotte's law, will be as 30 : : 42·50 : : 7 : : 9·8.

Having also seen by distillation that the quantities of heat or caloric in expanded, and in natural steam is as 38 : : 32, hence then as 38 : : 32 : : 9·8 : : 8·2 volumes of expanded steam that has been produced by the same quantity or equivalent of caloric required for the constitution of one volume only of natural steam of the same tension and mercantile value, and as these wonderfully distinct properties constitute it a chemically distinct and far more useful elastic fluid than steam, we propose to distinguish it, and to designate it by the convenient monosyllable "stame," instead of the more inconvenient, yet more truthful definition we have been able to arrive at, "subcharged steam;" for if it were still to be called steam, as it contains but one-eighth the

heat and one-eighth the water in an equal volume of equal tension, it must most surely be considered as subcharged steam, and now when its distinct constitution is understood and substantiated, still to term it "surcharged" would be as puerile and unphilosophical as to term steam surcharged water, or to term water surcharged ice, instead of appropriating a specific name to a specific object.

In arriving at the foregoing paradoxical conclusions, we have been led to and strictly guided by the indications of the different instruments employed, and by practical experiments upon working engines with these different kinds of elastic fluids as sources of motive power, our intention being to elicit useful truth, we therefore give full details, however singular it may appear, and certainly it does appear singularly curious; for though we consider it unquestionable, that invariable atomic equivalents of water and heat constitute steam of all densities and temperatures, and we must therefore rationally and of necessity expect that other proportions of heat and water must constitute another fluid distinct from steam; still it seems hardly possible to conceive that so nearly similar quantities of heat and water, merely from the union thereof under different circumstances, should constitute so different and distinct an elastic fluid as we have found it to be; yet we shall find the paradox not only confirmed by other experiments, but by a practical, experimental application of these distinct combinations of fire and water for the production of motive force, under circumstances designed for and admitting of the strictest investigation, and seemingly of an unquestionable nature, and notwithstanding the following unexpected discovery.

For being up to a late period unacquainted with, and not suspecting any influence of, mercurial vapour or fluid mercury upon heated steam in the foregoing experiments, particularly as we had experimentally proved that no mercurial vapour is formed from dry mercury heated to 660° within a glass tube under atmospheric pressure only; and again, when a volume of dry atmospheric air was confined by mercury within a glass eudiometer, it required about 480° of heat to double the volume of air confined therein. These joint results at first prevented our suspecting, and then for some time hindered our crediting, that the vapour of mercury any how interfered with the volume of steam in our experiments.

Notwithstanding this confidence, we found that mercury, or its vapour, exerts both great and surprising influence on the volume of heated steam in our former experiments; because the behaviour of heated steam is so different when confined by fusible metal, or by linseed oil, instead of mercury, in similar tubes, that there can be no doubt the volume of steam is greatly affected when heated in contact with mercury, and also very differently affected thereby at different temperatures when in contact therewith, the volume of steam being much lessened from 228° to 250°, little affected thereby at 500°, and greatly increased in volume at 600° and upwards; yet from a full comparison of this with other experiments presently detailed, wherein fusible metal or linseed oil were substituted, we are enabled to prove, though the rate of expansion is much altered by mercury, the total expansion of steam remains little altered thereby in the whole range of temperatures from 250° to 650°

For when metal formed of bismuth 5, of lead 3, of tin 2, fusible at about 210°, was employed to confine steam when heated within the same glass instrument to 650°, accompanied with a thermometer within a bath of fusible metal, then when the apparatus was subsequently allowed to cool, the corresponding descents of the fusible metal and thermometers consisted of equal decrements for equal degrees of heat, showing a great difference in the rate, and but little difference in the extent, of the whole contraction of the steam from 650° to 250°, and that little difference will nearly vanish when the subject is further investigated and more fully explained.

As these experiments were carefully made with the same identical instrument, well rinsed in nitric acid, by merely employing mercury in one experiment and fusible metal in another, the actual volume of steam employed in each case being produced under atmospheric + the pressure of the metallic column of 12·50 inches, the included volume of steam was therefore denser under the mercurial column than under the column of fusible metal, in proportion to the specific gravity of the respective metals, or as 13·58 :: 9·6. Therefore as 13·58 :: 9·6 :: 12·50 :: 8·88, that is to say, the column of fusible metal of 12·50 is only equal in gravity to a mercurial column of 8·88 inches. Then as 42·50 :: 38·88 :: 6·8 :: 6·2, the volume of steam found under fusible metal, which will be found to correspond so nearly with the reduced scales of the experiments, which will presently be given in diagram No. 4, proving clearly that the expansion of steam by heat is so nearly alike in extent in both cases, that it may be considered the same for the general purpose of this work, and in which it would be useless to divert the attention for a moment from the great and valuable matters under consideration to trivial and valueless minutiæ.

*(To be continued,)*

THE RELAY SYSTEM IN FACTORIES.

Sir,—The fearful mortality of young children in manufacturing localities would be alone strong evidence not only that the spirit of the ten hours' act should be enforced, but also that the working hours of women, young persons and children in factories, should be reduced to *less* than ten.

It is not possible that a woman who has laboured ten hours in a factory can bestow the requisite care upon her children; and, in fact, there is abundant evidence that whilst they are infants, mothers working in factories very generally resort to opiates for keeping their babies quiet—a quietude terminating too frequently in death. When the babe happens to survive this drugging, soon as it can go alone it is left, usually under no better care than that of some other child yet too young for factory employment; but such abandonment of young children is far from the only mischief that results from the working of women so long as ten hours in a factory. Few indeed are the women who, after ten hours of factory work, could have power, even should inclination remain, to perform any of their duties at home, even those most essential to cleanliness, comfort and health. In respect to young persons, twelve hours passed in the factory, ten of work, two for meals, cannot but indispose a girl for the practical acquirement of the many domestic qualifications requisite for the future good wife and careful mother. It is at an early period of a female's life that training in household management is most essential; it is in youth that practical skill is most easily acquired in preparing wholesome and savoury meals from cheap articles of food; so is it, in the thrifty reparation of apparel, and in the many other items of good management which make wages go far in providing comforts and render the artisan's home his delight, and his resort, rather than the public-house. As to children, variety of employment is as essential to them as is exercise in the open air. Were it desirable to impair the mental faculties of a child, how could the fact be better accomplished than by putting him for ten hours of a day to watch a sliver? Were the object to stint his growth and weaken his constitution, how could this be more effectually attained than by confining him for ten hours in a factory?

On the other hand, it will scarcely be denied that the child of a factory operative should be early trained in habits of industry and labour, that the boy is likely to become the better, the more industrious, the happier man, if early inured to the restraint and work of a factory; but this may be effected by proportioning his hours of labour to his years; and this seems to be what legislative interference is called upon to accomplish in regard to children.

It is of course supposed that young persons, and children especially, if relieved from too long attendance in a factory, would attend suitable establishments and schools for their furtherance in a knowledge of religion and morality, and that the child at least would pass some hours of every day in the ordinary business of a school.

So far, the well-being of the operatives has alone been spoken of, but there is another class of persons whose interest in justice cannot be forgotten—the *proprietors* of factories. If the working of a factory be limited to a small portion of the four-and-twenty hours, it is clear that a few hours work must pay the same rent as would the produce of a doubled activity, and the article, page 438 of your 1344th Number seems to indicate means by which a factory might be worked for sixteen or eighteen hours of the twenty-four without injury to either man, woman, or child employed in it. Not by any approach to the present shift system, but by regular distinct sets of operatives, working each set the number of hours most conducive to their well-being, and no more.

In the present movement amongst factory operatives, no ill-will has been manifested towards their employers; the only wish manifested in their meetings has been that of obtaining a limited period of daily labour for their wives and children, and that their times of work should be consecutive. It may, therefore, be reasonably hoped that the operatives would gladly embrace any plan which would benefit the manufacturer, if, at the same time, security were afforded that their wives and children should never be kept at work longer than the time stipulated for, and according to the spirit of the Act.

Retaining the spirit of the Ten Hours Act, but taking up its details with a view to limiting the work of women,

young persons, and children, to the period suitable for each of these classes respectively, it might be enacted that a factory might work for a greater number of hours than ten, provided in all cases that at least a *double set* of women, young persons, and children were engaged; that each set of those operatives should enter the factory at one and the same hour, and leave it, each set simultaneously, at another hour; and farther, that no individual of any set, after having left the factory, should be permitted under any pretence to enter it again during the same day.

Supposing a factory were permitted to work for 16 hours of the 24, the men might be left to their own discretion as to continuing for so long a day—they would probably take to some secondary employment for the half of it. As to women, two sets for the 16 hours should be by law required; the labour of young persons might without injury to them be of the same duration, eight hours that is.

But as eight hours confinement in a factory does not admit of the healthy development of a child's mental or corporeal faculties, it would seem that for the sixteen hours of work, not less than four distinct sets of children should be enjoined. The time of these children, after dismissal from the factory, might profitably be passed at school, till the time of their mother's return home; and the change from bodily exertion in the factory to sedentary occupation in the school would be agreeable no less than salutary to the child. It is sad to reflect that, as has been affirmed by good authority, in some manufacturing parts of Scotland, the earnings of children by a long day's work are so considerable, that parents not unfrequently live principally on their gains, indulging themselves in idleness, while their poor children are made to labour beyond their strength.

Why should not factory owners and their operatives consult amicably together as to the best means of securing the respective interests of both the employer and the employed? Masters are not accused of a wish to oppress their people; the operatives have no desire to injure factory proprietors: indeed, the increasing intelligence of the working class can hardly fail to render it evident that it is their interest, no less than that of their employers, that the produce of mills should be brought to market at the lowest possible rate of cost. Increase in the sale price of goods lessens demand for them, diminishes sale, causes factories to be closed, and throws people out of work; on the other hand, a great demand for goods occasioned by low, though remunerative prices, tends uniformly to the employment of more people in existing factories, and to the opening of new ones; thus, not only giving constant work to an increased number of hands, but leading also to augmentation of their pay.

Lord Ashley has alluded to the benefit factory men derive from working in gardens or allotments; were the practice of out-door labour habitual, as it would be (as suggested in the above-mentioned article in your Magazine) were the men to work but eight hours in a factory, robust health would not be the only advantage they would gain—they would have acquired skill and aptitude in a secondary employment, to which they could have recourse on any closing of a factory. Even the culture of a man's own allotment would afford a means of subsistence for himself and family till better times came round.

The following extract from the *Morning Chronicle* of February 4, 1850, exhibits the difference in the profits of a factory, as resulting from the single circumstance of working it a greater or lesser number of hours per day: "In so far as is not incompatible with the physical and moral well-being of the operatives, the factory-owner should be permitted to put his building and plant to the fullest use of which it is capable. Supposing him to have sunk 20,000*l.* upon them, and eight per cent. to be a fair average rent upon that capital, he has 1,600*l.* a-year to charge under the head of rent upon the produce of his factory. It is to be worked but ten hours of the twenty-four, that charge must be divided upon the work done in ten hours per day; but, supposing that work could be continued for twenty hours out of the twenty-four, 800*l.* of rent only would fall upon the ten hours' produce. He would in this case have a surplus of 800*l.* a-year to be retained as profits; or, as probably would be the result, to be divided partly in lowering the sale price of his goods, partly in an increase of profit to himself, and often in an increase of wages to his operatives."

B.

## TESTIMONY OF LORD BROUGHAM AGAINST THE EXHIBITION OF 1851.

(From the *Times* of 20th March)

House of Lords.—Lord Brougham rose in pursuance of notice, to move that an humble address be presented to Her Majesty for the production of a copy of the Royal Commission for the promotion of the Exhibition of the Works of Industry of all Nations, to be holden in the year 1851. He commenced his observations by calling the attention of his noble friend the Vice-President of the Board of Trade (Earl Granville), and of his noble friend at the head of the Woods and Forests, to that motion, and by expressing a hope that it would not be resisted. He wished at the outset of his remarks to guard himself against the supposition that he had brought the subject forward in order to bring into disrespect "the Exhibition of the Industry of all Nations." His belief was that it would indeed be an exhibition of the industry of all nations, and his only hope was that a due proportion of that exhibition would consist of the exhibition of the industry of the manufacturers and agriculturists of this country. He was perfectly confident that there would be a flocking of the natives of all countries with their wares and inventions, either into Hyde Park, or into the Green Park, or into the Victoria Park at the east end of the town (a laugh), or into any other park or place in which a depository for them was to be provided by the voluntary contributions of our countrymen. He greatly approved, and beyond all measure admired the admirable conduct of our tradesmen, shopkeepers, and manufacturers, who had so honourably to themselves, with the greatest disinterestedness, with the purest patriotism, with the utmost love to their customers, and with the kindest feelings to their customers' pockets, assented to a proposition *which must lower the price of all the goods and wares which they made and which we consumed.* ("Hear, hear," and some laughter.) It was a most convincing proof that nothing could be more unfounded than the celebrated attack of Dr. Adam Smith on the spirit of the trading and commercial community, and so often quoted of late years in both Houses of Parliament. Dr. Adam Smith had said, that nothing could be more mean, narrow, or contracted than the views of the manufacturing and trading interests, especially when contrasted with the quiescence of the agricultural interest,—a quiescence which might have existed in his time, but which had certainly disappeared during the last autumn under the auspices of some of his Protectionist friends near him. *He had no doubt that both the trading and the manufacturing interest would lose a great deal presently, even though they might gain a good deal ultimately. They would bring their goods to a market where they would be obliged to sell them at a cheaper price than ordinary, whilst the foreigners of all nations would bring their goods to a market where they would sell them for a price far dearer than any which they could hope to obtain in their own country.* The competition, however, would do ultimate good to the trader and manufacturer of England: they would obtain something by the exchange of ideas, and would, no doubt, learn something whereby to improve the fabric of their manufactures. *They would not, however, increase the price of their commodities and manufactures. No, no; down, down, down would come the prices;—and so much the better would it be for us the consumers, and ultimately no doubt for themselves. They would not, however, find this so sweet in the taste as it was in the prospect.* But they had made up their minds, and were furnishing their subscriptions; and he considered this as a tribute to the advanced spirit of the age, given by the manufacturer to the agriculturist, to compensate for the loss which the latter had sustained in the withdrawal of protection. He hoped that it would be as gratefully accepted by his noble friends of the Protectionist school, to which he did not belong, as it would be by himself, a pupil of the Liberal school, which took equal interest in cheap corn and in cheap goods. It was not from any hostility to this proposed Exhibition of the Industry of all Nations that he offered these remarks to their lordships, but from a sincere wish that a great evil might not be inflicted on this metropolis—from a sincere wish that one of the lungs of this great capital might not be choked up by the erection of a huge building, which he should call a tubercle upon them, and which must occupy a space of 20, 30, or even 50 acres; for the building must, he inferred, be very huge, if it were really intended to contain the industry of all nations, *though perhaps the contribution of British industry to it might be small indeed.*

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## ATTWOOD AND RENTON'S PATENT STARCH.

We now give the specification of this invention as promised in our last:

*Specification.*

Our improvements consist in effecting the separation of starch from the other substances with which it is combined in farinaceous and leguminous substances by a more expeditious process, and by the use of cheaper agents than those commonly in use. And

in order that these improvements may be clearly understood, we shall by way of exemplification describe the mode in which we manufacture starch from rice, and point out those parts of the process which we claim as being new and of our invention. We take whole, or broken grains of rice, with or without the husk, or rice flour, and throw them or the flour into a shallow or other convenient vessel. We then pour in a solution of lime and chloride of sodium (common salt), sufficient to cover the whole of the rice, that is to say, about 26 gallons of the solution to about 112lbs. of the rice. We make this solution by mixing slacked quick lime and chloride of sodium and water in the proportion of about 100 lbs. of lime and 30 lbs. of chloride of sodium to 500 gallons of water, or in any other like proportional quantities. But we do not confine ourselves to the above proportions, as other proportions might be used, though with less advantage. The solution thus made is to be allowed to settle and the clear top liquor only drawn off for use. We let the rice remain thus submerged for about six hours, stirring it well every half hour. We then draw off the liquid by means of suitable taps, and cover the rice with a fresh quantity of a similar solution; the rice is then exposed for six hours to the action of the solution, being well stirred once every half hour as before; after which the liquid is to be drawn off, when the rice is ready to be ground. The grinding is effected in the usual way, and the ground rice transferred to what is called a "rousing vessel," and covered over with a quantity of a similar solution as before mentioned. The ground rice is then to be well stirred or roused for about two or three hours. From this vessel the rice is removed to a separating vessel or vessels, in which it is left to stand for about six hours, in order that the starch may be separated from the gluten with which it is combined. To save time we generally perform the stirring or rousing process the last thing at night, so that the separation may be effected before morning. On examining the separating vessel or vessels, a thick or creamy matter is found deposited at the bottom, which is the starch mixed with a portion of fibrine, while the gluten floats near the top of the liquor. We then draw off the liquor as close as may be to the creamy deposit, and fill up again with cold water, which after a little time is also drawn off. The starch or starchy matter is now to be separated from the fibrine with which it is intermixed in the usual way, adopted by rice starch makers. For the purpose of facilitating the separation of the starch from the fibrine in the water, we sometimes use a sliding or telescopic tube placed vertically over an outlet at or near to the bottom of the vessel, and so that the upper end of the tube can be gradually, and from time to time depressed, until the whole of the starch floating in the water has been run off from the fibrine which falls towards the bottom. The moist starch is run into a receiving or filtering vessel, made with a false bottom, or side, consisting of one or two, or more plates of perforated zinc or woven wire, or other suitable material, with an intermediate sheet of cotton, linen, or some other like fabric, the whole being carefully fastened, so that none of the starchy matter may escape through. From between the bottom or side of the vessel and the perforated zinc plate, or plates, or other suitable material, there is a pipe which leads to an exhaust pump. On the starchy matter being run off into the receiving or filtering vessel, the pump is set to work, when it draws off all or most of the excess of water with which the starch is charged, but brings off also along with the water a portion of starch which the meshes of the false bottom or filter have failed to intercept. The pump therefore is made to empty itself into a long shallow trough, or a series of shallow troughs communicating with each other, so that the starchy water may have to run a long distance before it is finally allowed to run to waste, and so as during its progress to deposit the whole of the remaining starch. For this purpose the trough or series of troughs should be placed so as to cause a continuous, but very gentle flow of the water, say at an inclination of about 1 inch in 100 feet. The width of the trough or troughs should be in proportion to the quantity of water holding the starch in suspension, and it will be better if the depth does not exceed 4 inches. We have found in practice that in a run of about 300 feet the water will come off perfectly clear and free from starch. The whole of the starch which has been thus separated and collected is now ready for what is called "boxing," after which it is to be dried in the usual manner. The gain so far, is such by the means and methods we have described, that is to say, by the use of the lime and salt solution and processes aforesaid, that we can advance the manufacture of starch in about forty-eight hours to the same stage, which it now takes, about one hundred and thirty-two hours and upwards, to arrive at, and obtain, besides an increase of from 6 to 7 per cent. in the quantity of starch produced. The starch is, we believe, also much purer than any obtained by means of a caustic alkaline, or acid solution, and fitted for all purposes to which wheaten starch produced by fermentation is usually applied. We prefer using the solution of lime and salt cold, because more lime can

be dissolved in cold than in hot or warm water, and because also the risk of fermentation is thereby diminished; but we do not confine ourselves to the use of the said solution at any particular temperature. Starch of a good quality for some purposes, though not for all, may also be made by using solutions of lime alone in the manner before specified; in which case, however, we make the solution of lime with cold water, and use it in that state only, and confine our claim to the use of it in that state. The same lime and salt solution as aforesaid may also be employed with the like good effect in manufacturing starch from rye, peas, beans, and other leguminous substances, and in the preparatory steps also of the manufacture of other like articles of commerce, such as dextrine or British gum.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 21st, 1850.

Charles Marsden, of the Kingsland-road, Middlesex, marble paper maker. *For improvements in traps to be applied to closets, drains, sewers, and cesspools.* Patent dated September 20, 1849.

*Claims.*—1. The construction of traps for closets, drains, sewers, and cesspools, of a drum or series of buckets, caused to revolve by the weight of the matters falling into the same, and made air-tight by overhanging and side flaps of vulcanized caoutchouc, or other suitable substance.

2. The forming of the discharge aperture of the closet-pans of an oblong form rounded at the ends, or of an oval form.

[We shall take an early opportunity of giving a full description, with engravings, of this ingenious invention.]

Josiah Lorkin, of Ivy-lane, London, merchant. *An improved instrument or apparatus for beating or triturating viscous or gelatinous substances.* Patent dated September 20, 1849.

*Claim.*—Beating or triturating of viscous or gelatinous substances by means of an instrument or apparatus consisting of a cylinder (or other suitable vessel) containing in the inside thereof projecting beaters, or interstidial diaphragms.

Thomas Griffiths, Islington-row, Birmingham. *For improvements in the manufacture of tea and other pots and vessels, and other articles made of stamped metal.* Patent dated September 20, 1849.

The patentee proposes to manufacture the various articles of stamped metal alluded to in the title, of sheet tin, or copper, or other suitable strong metal, which serves as a lining to a vessel of Britannia metal, in order to obtain strength, and the cohesion of solder under heat. The lining and casing are stamped with the same dies, and the union of the two promoted by burnishing.

*Claim.*—The mode of manufacturing tea and other pots or vessels of Britannia metal, lined or strengthened by stronger metal.

Benjamin W. Wren, Yarm, York, miller. *For an improvement in cleansing and treating certain descriptions of wheat.* Patent dated September 20, 1849.

The description of wheat proposed to be operated upon is that imported from "foreign parts," which is hard, brittle, and dirty, having, when ground in the usual manner, a dirty appearance and musty smell. To get rid of these disadvantages, the wheat is first washed in a cylinder, to free it from earthy particles, then transferred to a straining cylinder revolving on a hollow axle, heated by steam or hot water; after which, it is removed to a third cylinder, heated exteriorly, where it is partially dried; and, lastly, the wheat is placed in a fourth cylinder, where it is completely dried by the passage of steam or hot water through the hollow axle, and around the external periphery thereof.

David Owen Edwards, Sydney-place, Brompton, surgeon. *For improvements in the application of gas for producing and radiating heat.* Patent dated September 20, 1849.

The chief feature of this invention is, the employment of gas-burners, constructed of pipeclay, or other suitable argillaceous material, in the form of bulbs, which are perforated with numerous holes. The supply of gas to these burners is regulated in such manner that air may enter the lower holes, and mix with it, so that, after the bulb has become heated, it will be covered with a thin yellow flame. Mr. Edwards describes several constructions of stoves, composed of earthenware, or earthenware and metal combined, for heating and cooking, in which these bulb gas-burners are employed for the production and radiation of heat.

*Claims.* — 1. The construction of gas burners of pipeclay, or other suitable argillaceous material, perforated with holes, and adapted to the production and radiation of heat by the application of gas.

2. The construction of stoves of earthenware, or other argillaceous material, with a double casing for the passage of air in combination with gas burners constructed as before described.

3. The construction of cooking stoves or ovens of earthenware, or other argillaceous material, in combination with gas burners constructed as before described.

Henry Bessemer, Baxter-house, Old St. Pancras-road, engineer. *For improve-*

*ments in the preparation of fuel, and in apparatus for supplying the same to furnaces.* Patent dated September 20, 1849.

ELIJAH GALLOWAY, Southampton-buildings, Chancery-lane, engineer. *For improvements in furnaces.* Patent dated September 20, 1849.

*Claims.*—1. Causing the fire-bars to rise and fall, in combination with a to-and-fro longitudinal motion, so as to advance the fuel from the front to the back, and throw the refuse over into the pit.

2. Giving motion, by eccentrics, to cause the rising and falling, and to-and-fro motions of the fire-bars.

JOSEPH ROCKE COOPER, Birmingham, gun and pistol maker. *For improvements in fire-arms.* Patent dated September 20, 1849.

This invention consists in placing underneath the stock of the gun a bent lever, turning on a pin, one end of which is hollow, and covers what constitutes the nipple, while the other end terminates in a ring for the finger. When the piece is loaded and ready for use, the hollow end of the lever is kept over the nipple by a spring hammer pressing against the back of it; and when the discharge is to be effected, the lever is pulled round until the hollow part passes the end of the spring hammer, which will then react and strike against the cap, causing the powder to explode. To place the cap on the nipple, the barrel is partially turned round, and, after priming, is returned to the first position. To prevent accidents, the ring end of the lever is provided with a guard, which has to be slidden out of the way, before the bent lever or trigger can be moved. The patentee describes, lastly, how this principle of construction can be modified and applied to revolving pistols or guns.

WILLIAM EDWARD NEWTON, Chancery-lane, C.E. *For certain improvements in pumps, and in machinery or apparatus for working the same, which latter improvements are also applicable for working other machinery.* (A communication.) Patent dated September 20, 1849.

The patentee describes and claims—

1. A steam pump, which consists of a casing divided in half by a flexible diaphragm. The lower part communicates with the source of supply, and with the outflow, by means of two pipes fitted with valves, one opening inwards and the other outwards. The top half communicates with the steam boiler and condenser. The *modus operandi* is as follows:—Supposing a vacuum to be created in the lower half, then the water will rush in —provided always that its height above the source of supply does not exceed that to which water may be forced by atmospheric pressure—and the diaphragm ascend until it strikes against the stem of the steam valve, and thereby cuts off communication with the condenser, and establishes it with the boiler. Steam will then rush in and force the diaphragm downwards, closing the entry valve and opening the outflow one, whereby the water will be driven out. When the diaphragm arrives at a bottom, it strikes against the top of a spindle, which, through the intervention of a bent lever, will cut off communication between the top half of the casing and the boiler, and open it with the condenser. The top half of the casing will be exhausted of steam, and a vacuum created in the lower half, and the round of operations repeated.

2. A double steam pump, constructed on principles similar to the preceding, with such modifications, however, as would readily suggest themselves to any one conversant with mechanical construction.

3. A steam boiler furnace, in which the steam and products of combustion, after impinging against the bottom of the boiler, which is connected with a water vessel placed under the furnace-bars by means of vertical pipes, are made to pass over and under water vessels placed in a heating chamber, and to circulate amongst perpendicular tubes which connect the vessels together.

4. A "volcanic steam generator," which consists of a water vessel, in which is placed a fire chamber, communicating with the exterior by means of a hollow pipe, and fitted at top with a pipe curved downwards, and opening into the water. The chamber is partly filled with coal, and then powdered coal and nitrate of soda introduced, which is ignited by a fuse. The tube is filled with sticks of nitrate of soda, and communication cut off with the exterior above it. The patentee states that the fire will burn furiously, and the heat and products of combustion be expelled down the curved tube into the water, whereby steam will be rapidly generated.

5. A combination and construction of steam pressure gauge, and thermometer, in which, among other arrangements, a column of cold water is interposed between the steam and mercury, to prevent the glass tube breaking.

WILLIAM HANDLEY, Chiswell-street, Finsbury, confectioner; GEORGE DUNCAN, Battersea, engineer; and ALEXANDER MC GLASHAN, Long-acre, engineer. *For improvements in railway breaks.* Patent dated September 20, 1849.

The patentees describe and claim a peculiar construction of break, the skid of which is forced underneath the wheel—between it and the rail—so as to partially lift the wheel, and allow the carriage to slide along

upon the skid. The breaks may be supported in pairs by a rod running on the axles of the wheels, or on a connecting-rod underneath the carriage. The breaks are worked in the usual way.

WILLIAM EDWARDS STAITE, Lombard-street, gentleman, and WILLIAM PETRIE, King-street, gentleman. *For improvements in electric and galvanic instruments and apparatus, and in their application to lighting and motive purposes.* Patent dated September 20, 1849.

The improvements comprehended under this patent form the subject of fifteen different claims, each of which again embraces several particulars. We shall give in an early Number a very full abstract of the whole, with engravings.

WILLIAM BUCKWELL, Artificial Granite Works, Battersea, C.E. *For improvements in compressing or solidifying fuel.* Patent dated January 3, 1850.

In consequence of this patent extending to the Colonies alone, the specification is only a copy of the one previously enrolled and described, vol. li., p. 328.

*Specification Due, but not Enrolled.*

JOHN BAPTISTE VULDY, Mile-end, dyer. *For improvements in giving a gloss to dyed silk in skeins or bands.* Patent dated September 20, 1849.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Robert Milligan, of Harden, near Bingley, York, manufacturer, for an improved mode of treating certain floated warp or weft, or both, for the purpose of producing ornamented fabrics. March 18; six months.

George Jenkins, of Nassau-street, Soho, Middlesex, gentleman, for certain improvements in the means of producing motive power. March 18; six months.

Thomas Edmondson, of Salford, Lancaster, printer, for improvements in the manufacture of railway and other tickets, and in machinery or apparatus for marking railway and other tickets. March 19; six months.

William Joseph Horsfall, and Thomas James, both of the Mersey Steel and Iron Works, Toxteth-park, Liverpool, Lancaster, for improvements in the rolling of iron and other metals. March 19; six months.

Samuel Cunliffe Lister, of Manningham, near Bradford, York, and George Edmond Donisthorpe, of Leeds, in the same county, manufacturer, for improvements in preparing and combing wool and other fibrous materials. March 20; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Mar. 13 | 2225 | Thomas Hook | New-cut, Lambeth | Portable bed-room fire-escape. |
| 14 | 2226 | William Sellars | Sheffield | Saw-back. |
| ,, | 2227 | Ritchie and Son | Edinburgh | Printing and embossing machine. |
| ,, | 2228 | Daniel, William, and Thomas Bentley | Margate, Kent | Spiral spring compasses. |
| 15 | 2229 | J. and W. Vokins | John's-street, Oxford-street | Revolving standard folio frame, for prints, drawings, &c. |
| 18 | 2230 | Haldane and Rae | Edinburgh | Part of a tap for drawing off liquids. |
| ,, | 2231 | Andrew Robertson | Renfrew | An apparatus for weighing, measuring, and registering. |
| 19 | 2232 | John Le Blanc | Huddersfield | Chest expanding and equalising apparatus. |
| 20 | 2233 | James Wood | Stockport | Shuttle-weight, and thread or yarn presser. |

## CONTENTS OF THIS NUMBER.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1390.] SATURDAY, MARCH 30, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

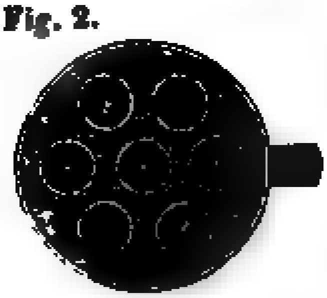

## MR. BOGGETT'S PATENT GAS STOVES.

Fig. 4. Fig. 6. Fig. 8.

Fig. 1. Fig. 10.

Fig. 3.

Fig. 2.



## MR. BOGGETT'S PATENT GAS STOVES.

(Patent dated September 2, 1849. Specification enrolled March 2, 1850. Patentee, Mr. William Boggett, of St. Martin's-lane, Manufacturer.)

### *Patentee's Specification.*

FIG. 1 is a vertical section, and fig. 2 a horizontal section on the line *y z* of an improved stove, in which carburetted hydrogen gas is proposed to be employed as the source of heat. A is a cylinder, which forms the body of the stove, and is closed in at top and bottom by plates *a b*; B B are a series of conical air tubes of earthenware or metal, which are fixed, with their broad ends uppermost, within the cylinder, being closely fitted with apertures made for them in the top and bottom plates *a* and *b*, so that they shall have no communication with the surrounding spaces *c*, *c*, *c*, *c*. C is a ring of gas-burners, which may be supplied from any convenient source, which are pierced with holes on those sides only which face the conical air tubes B, so that the streams of flame may impinge directly upon the tubes; *e e* are apertures for the supply of air to the gas-burners. D is a flue, which carries off into the chimney the smoke and vapour which accumulate in the spaces *c c*. E is a chamber at the top of the stove, for the reception of the warmed air which ascends the conical tubes B B; and F is a perforated regulator, by which the quantity of heated air admitted into the chamber or apartment where the stove is placed can be regulated at pleasure. It will be seen that, from the manner in which the parts of this stove are arranged, no intermixture of the products of combustion with the air to be warmed can take place, and that one of the chief objections to the use of stoves of this description is thus completely removed. Fig. 3 is a vertical section of another form of stove, in which coal or coke is intended to be employed as the source of heat (but to which gas may be also applied). A is a cylindrical case of iron; B an open fire-place raised on the bottom of A; C is a hollow, conical-shaped lump of fire-clay, which dips into the centre of the fire-place, and is upheld by a circular ledge *d*, which projects from the inside of the case. D is a second lump of fire-clay, which rests upon, and is nearly of the same shape as the other, the apex of the one (D) fitting into the hollow of the other (C), but so as to leave an open space *m* between them. E E are two passages, through which a constant supply of fresh atmospheric air is conveyed from the outside of the stove into the open space *m* between the two fire lumps, where it becomes warmed by the heat extracted from the under fire lump (C). *f f* are vertical passages formed in the upper fire lump D, through which the air heated in *m* ascends into a chamber F at the top of the stove, from which its escape into the surrounding apartment is regulated at pleasure (as in fig. 1) by a perforated cover $F^2$. G is a pipe, which conveys the smoke and vapour from the space immediately over the fire-place to the chimney, all escape thereof in any other direction being prevented by the close fitting of the under conical fire lump into the circular ledge *d*.

Fig. 4 is a vertical section, and fig. 5 a horizontal section on the line *a y* of a gas stove differing in its construction from those before described. A is an outer cylinder of iron; B a circular hood of fire-clay, which rests on the bottom of the case A, and contains a ring E of burners, which are supplied with gas from a tube F; G G are a set of vertical tubes of earthenware, open at both ends, by which the hood B communicates with a smoke box H at the top of the stove. *a a* are apertures in the bottom plate of the outer case, up through which streams of atmospheric air are constantly flowing into the hood, from which they ascend in a heated state (less the portion required for the combustion of the gas) through the pipes G G, imparting a high degree of heat thereto. J is a pipe which carries off the smoke and vapour which collect in H into the chimney, and *b b* are apertures in the outer case for the admission of atmospheric air, into the space between the outer case and the interior hot air tubes (G G), where they become warmed by contact with these tubes, without acquiring any of the empyreumatic odour which belongs to air heated by direct contact with flame or with metallic surfaces, and from which they are distributed to the surrounding apartment by a perforated regulator $F^2$, as in the other gas stoves before described.

Fig. 6 is a vertical section, and fig. 7 a plan, partly in section, of another description of gas stove. A is an outer case of metal. B a hollow cone of earthenware,

which incloses a ring of burners, C, which are supplied with gas from a pipe, D; *a a* are apertures for the supply of air to the interior of the cone. *bb*, apertures for the supply of air to the space around the cone. H a pipe for carrying off the smoke and heated vapour from the top of the cone to the chimney, and F a perforated cover which regulates the diffusion of the air, which has been warmed by contact with the cone, into the surrounding apartment.

Figs. 8 and 9 exhibit a modification of the gas stoves represented in figs. 1 and 2, and in figs. 4 and 5; the only difference being that in this case the escape-pipe H is turned downwards, in order that it may be carried under the floor of the apartment towards the chimney.

Fig. 10 shows a modification of the stove represented in figs. 6 and 7. Instead of a ring of gas burners being all in one plane, a series of burners, C, rising one above another in conical succession, are employed as shown, the flames from which impinge against, or are projected towards the interior sides of the cone B. The escape-pipe H also passes straight upwards through the top of the stove into the chimney.

Fig. 11 represents a further modification of the stove represented in figs. 6 and 7. The cone B is here inverted, and the air passes through it which is intended to warm the apartment, while the burners C are placed in the space exterior to the cone, and arranged in the same successional order as in fig. 10.

In all the stoves which have been hereinbefore described, the air to be heated, instead of being taken from the apartment in which the stove is placed, may be conducted from the open air on the outside by means of a pipe or pipes suitably laid and connected.

## NAVAL PRACTICE.

Sir,—The following sketch of a letter intended twenty years ago for a periodical of that day, has been found amongst Sir Samuel Bentham's papers, and, notwithstanding the improvements that have since that time been introduced, his observations apply almost equally well to the present time, and may, therefore, be worth a place in your valuable columns.

M. S. B.

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Mr. Editor, — Much that has been written and said on the subject of naval warfare seems to imply that vessels of one particular class would necessarily oppose themselves only to vessels of a similar class in the service of the enemy —just as knight opposed himself to knight in the days of chivalry, and plebeian to plebeian only. We hear that our frigates, for instance, must be increased in size and force to make them on an equality with the frigates of such another nation—our ships of the line so and so constructed to meet similar ships which such another country has been pleased to build. The fact, however, is, that in actual warfare, commanders of British vessels of war never shirk engagement with an enemy, even of much superior force, whenever the smallest chance appears of success; nor does a British captain, on the other hand, disdain combat with an enemy of inferior force. In my view of the matter, it were better for us to have done with this useless comparison of frigate with frigate, and so on, and to begin instead, to consider what really are the qualities, of a vessel of war that are most desirable, and most efficacious in the greatest possible variety of circumstances; to contrive our armaments accordingly, so as to fit them for the greatest number of services individually, and to suit them to a combination of individual forces when required to oppose a great hostile fleet.

Our ignorance in naval matters—that is, the ignorance of all the world—as regards ships themselves, and the manner of arming them, is, I had almost said, complete as regards several of the most important points of consideration. We know that it is true that, *cæteris paribus*, a heavy shot will go further than a light one, and that a large shot will make a larger hole than a small one; but here ends our positive knowledge; every thing further is matter of opinion. We do *not* know what is the precise length of gun, nor what the charge of powder which, when combined with the most efficacious mode of mounting the piece, will, under the

greatest number of circumstances, throw any given shot the farthest. Still less do we know how many out of a given number of shot will on an average strike so small an object as a ship, that ship being at the distance at which engagements at sea usually take place. We know, indeed, that the proportion is a very small one, and hence the general opinion amongst naval men that engagements at short distances are most advantageous.

I have been these five-and-thirty years proposing and urging, by word and by pen, by arguments and by facts, the need which exists for experiments; not partial ones, but experiments based on general principles. Experiments which should decide some of the fundimental particulars on which the efficiency of every naval armament must depend under any and all circumstances; these experiments, as in regard to all others, so made, as that one particular only should be the object of each experiment, all other circumstances being similar. These particulars ascertained, it would then be comparatively easy to combine and modify our naval armaments to suit the circumstances of the times. But the easy and cheap experiments that would determine the most essential points have the misfortune of being too simple; thus appearing insignificant, and beneath the dignity of naval administration; yet for experiments on a large and grand scale, the nation has joined in spending thousands, tens of thousands, even millions, and this without having ascertained almost any one of the most essential points.

We do not yet know what number out of 100 shots, thrown from the same gun and carriage, with the same quantity of the same powder, will on an average strike a ship at sea at different distances, say at 500, 600, 700 yards, and so on; we do not know this even when the ship has but little motion, still less when it is in an agitated sea, and in a gale of wind.

The distance to which it is desirable to throw a shot being given, we do not know what the shortest length of gun may be which, to a certainty, will, with the most advantageous charge of powder, throw a shot to that given distance.

We do not know what thickness of metal is requisite for a gun, so as to enable it to withstand the most advantageous charge of powder for any shot, so that that thickness shall be sufficient, but not more than sufficient.*

In respect to the different carriages and modes of mounting a gun that have been tried, or even of those in use, we do not know of all the different carriages that have been tried, the gun in other respects being under the same circumstances, which carriage it is, that enables the gun to throw a shot the farthest—still less do we know which carriage admits of the greatest quickness of loading and firing—nor which requires the fewest men—nor which is least liable to injury in use—nor which the most easily repaired at sea—nor which least injures the ship on which it is mounted—nor which occupies the least space on board ship, especially space needful for the essential evolutions and purposes of the ship†: nor are we better acquainted with other particulars on which the comparative excellence of a gun-carriage more or less depends—such, for instance, by the use of which particular gun-carriage, the fewest men have been disabled when in action with the enemy.

As to the ship itself, we do not know the essential particulars of the best proportions respectively of length, breadth, and depth, to facilitate the swift and easy passage of the vessel through the water.

We do not know the shape of a ship that most easily passes through water in its different states—as a state of repose, of small waves, of short and large ones, of long and large ones, and this even when the ship is going before the wind, —still less do we know these particulars in respect to all the different circumstances to which a vessel is exposed when going in other directions.

We do not know what *size* of ship, all other circumstances being the same, will on a long voyage, make that voyage in the shortest time.

We do not know the form and dispo-

* Hence our carronades cannot bear the charge of powder to throw the shot to the greatest distance the length of the piece itself would admit of; whilst on the other hand, guns of other descriptions are much heavier than they need to be to resist even the greatest charge of powder.

† Great progress has of late years been made on board the *Excellent* in these respects; but still it does not appear that the numerous experiments that have been made have determined *positively* any one of these points. Note 1850.

sition of sail most advantageous under different circumstances, — whether the greater part, or the whole quantity should be low down, or what proportion may most advantageously be continued of its greatest breadth to such or such a greater height.

We have never in the structure of a ship, or of any of its parts, brought the mode of putting it together to the test of the well known principles in mechanics on which strength is known to depend.

We have never considered what the receptacles are that in the interior of a ship are best suited to the preservation of her various stores, nor how they can most conveniently be got at for use, nor how they can be stowed in the least space; still less has it been considered how those receptacles might best contribute to the strength of the structure itself.

## FRAGMENTS FROM AN INTENDED NAVAL ESSAY ON THE STRUCTURE OF NAVIGABLE VESSELS. BY THE LATE BRIGADIER-GENERAL SIR SAMUEL BENTHAM.

Besides the strains to which the exterior of a navigable vessel is exposed, its interior is subjected to many others—some of them consequent on dead weight necessarily placed in or on some particular part of the vessel, whilst the locality of others of the weights is optional.

Masts, for example, are necessarily along the middle line of a vessel, and the guns along the sides or at the end of it; but the place for shot, provisions, water, and stores in general, is optional.

In regard to weights which must be in specific places, an object of prime consideration in the construction of a vessel should be, to give strength to the parts of it thus particularly exposed to strains; and in respect to weights where the situation of them is optional, they should be placed in parts of the vessel where the strain occasioned by them would be least injurious.

Strength against these strains may be most certainly and economically effected by rendering the *interior fittings* subservient to support against particular strains.

The interior fittings of a vessel consist in receptacles for the various articles of stores, and of partitions for the accommodation of the crew.

Water tanks afford an example of the strength that may be given by receptacles for stores. Instead of those tanks being, as at present, unconnected either with the ship or with each other, they might be made really a part of the structure of the vessel itself*—the bottoms of the tanks a part of the bottom of the ship, fastened firmly to the bottom planking, and so formed as that the keel and bilge pieces might be connected with the bottoms of the tanks; this part of the tanks would thus afford strength to the bottom of the ship equal to the quantity of material used for the purpose of holding water,—a quantity which, whether of wood or iron, is always considerable. So also, the sides of tanks, if made of a shape to correspond with the shape of the interior of the vessel's side, might, in like manner, form that part of the sides of the vessel appropriated to the water tanks.

Tanks of the same nature might be profitably adopted as receptacles for biscuit, and for various other stores.

So—in continuance of examples where internal fittings might be made conducive to the strength of a vessel in resisting internal weights—bulkheads may be adduced. Bulkheads, resting upon the partitions of the tanks, might be carried up both transversely and in the middle line of the vessel, in places where they would most effectually resist partial strains; for instance, under masts, and under heavy ordnance.

### *Sliding Keels.*

The change of form of the vessel by the protrusion of sliding keels, and the power they afford of producing quickly this change at pleasure, is of very great importance; a considerable acquisition of power is obtained by their means to influence the motion of the vessel through the water, and the action of the water on the vessel.

Besides the giving the power of increasing the lateral resistance of the vessel, by the direct impulse on the whole area of the extent of these keels, an augmentation of progressive motion is obtained, whilst no other disadvantage is incurred than that of the direct impulse of the edge which divides the water,

* The water tanks in Sir Samuel's experimental vessels were so constructed.

together with the friction only of the sides.

Perhaps a still greater use of sliding keels is, that of the power they afford to increase the lateral resistance of either end of the vessel at pleasure.

The imperfection of sliding keels is, that they require a depth of water beyond what would otherwise be sufficient for the vessel, and thereby it is deprived when in shallow water of the advantages which are acquired in deep water by means of such keels.

MESSRS. STAITE AND PETRIE'S PATENT IMPROVEMENTS IN ELECTRIC AND GALVANIC INSTRUMENTS, AND IN THEIR APPLICATION TO LIGHTING.

We are obliged, by a delay in the execution of the numerous engravings required to illustrate the specification of this patent, to defer till next week the full abstract of it which we promised in our last; but we give, in the meanwhile, the claims in full, which will enable the intelligent reader to arrive at a tolerably correct general idea of the improvements effected by the patentees, some of which appear to us to be of great importance.

*Claims.*

*First.* We claim the hydro-barometers described, and the employment of them in the cells of galvanic apparatus so that the fresh liquid supplied has to pass through them, whereby the relative degree of exhaustion of the liquid in the cells is indicated to the eye at any moment by the difference of level between the liquids interior and exterior to the tube.

*Second.* We claim the inclosing porous materials, such as may be used for ordinary capillary syphons for the liquids of galvanic batteries, in flexible waterproof tubes (vulcanized caoutchouc being the material preferred) as described, and the use of a clamp or plug, to act on the sides or orifice of the waterproof envelope of the syphon, so as to regulate the discharge of the liquid as may be desired.

*Third.* We claim the process of covering articles used for galvanic batteries, or in connection with them, with a coating of sulphur, as described.

*Fourth.* We claim the improved gravitation supply apparatus described; that is to say—the use of a closed reservoir, placed below the battery, connected with the cells of the battery by tubes in such manner that the exhausted liquid, which becomes dense by being used, shall flow down one tube and rest in the lower part of the reservoir or cask, while the hydraulic pressure of this denser liquid in the said tube shall drive a supply of the fresh liquid from the reservoir up the other tube into the cells.

*Fifth.* We claim the "negative supply apparatus" by gravitation, described; that is to say—the use of a tray or shallow reservoir to hold a supply of such liquid or solution as becomes specifically lighter by being used in the battery, in combination with syphons connecting it with the battery—one syphon leading from the lower part of the liquid in the tray to the lower part of the similar liquid in the galvanic cell, while the other syphon leads from near the surface of the liquid in the cell to near the surface of the liquid in the tray. And also the use of a colander or porous support in the said tray, to hold matters to be dissolved in the liquid that is used when the liquid is of such sort as to render that desirable. And also the application of sulphur to the interior of galvanic batteries, to render the joinings water-tight and acid proof.

*Sixth.* We claim the self-clearing capillary-tube syphon described; that is to say—the use of syphons composed of capillary tubes, which have a conical or trumpet mouth at their lower ends where the liquid is discharged, whereby they clear themselves of any air bubbles that may enter the tube.

*Seventh.* We claim the use, in double-fluid galvanic batteries (in lieu of dilute acid), of a saline solution next the positive plate of a galvanic cell, in combination with a different solution next the negative plate of the same cell, with a porous diaphragm between them, as explained.

*Eighth.* We claim, in regard to the improved concentric cell described—first; the employment of a hole or bore from the top part of the negative element to its lower part, and channels cut in the said element horizontally from the aperture of the said bore at its lower end to different parts of the sides of the element; second, the use of the negative element of a polygonal section, or grooved vertically, so that while it fits as close as may be to the sides of the porous cell, there shall remain vertical passages between the two surfaces for the liquid to pass upwards at every part of the horizontal section of the negative surface; third, the reduction of the horizontal section of the negative element from a little below the surface of the liquid in the cell upwards, so as to leave a freer space for the subsidence of bubbles, and to prevent the motion of the negative element from splashing the liquid over; and fourth, the use of a band or strap of metal (copper being preferred) drawn tight around the top part of the negative element by means of a screw, so as to

obtain firm contact at many points between the negative element and the strap, for the purpose of conducting the electric power.

*Ninth.* We claim the improved arrangement or construction of galvanic battery, where a large number of cells are to be employed, as described.

*Tenth.* We claim the inclosing of such galvanic batteries as emit vapours or gases within a case which has a cover or lid that is made air-tight by means of a water lute, as described. (In the channel into which the edges of the lid fit, various solutions may be used in place of simple water to neutralize the nature of the gases evolved; thus, for the nitric-acid batteries a solution of lime may be used. Plates of glass may also be set into the top of the cover, whereby the condition of the batteries may be examined). We also claim the use of the air-tight arrangements for supplying and drawing off the liquids of such batteries; namely, the introduction of tubes for such purposes through sheets of vulcanised caoutchouc stretched tight, or secured without tension over holes in the case or cover of the battery; the holes in the caoutchouc being cut smaller than the tubes which are to pass through them, make a very air-tight but flexible joint. Also we claim for the same purpose the use of a hydraulic trap in any tube or trough used for supplying or discharging liquids to or from such batteries, as described.

*Eleventh.* We claim in regard to the treatment of iridium, and of the manufacture of articles in that metal, for the purpose of our invention: First, the formation of a bed from the powder or grains of the iridium itself on which to fuse the iridium by the passage of the disruptive discharge of electricity. Second, the use of a solid piece of iridium itself as the opposite electrode in the process of fusion, as described. And, third, the process of working a solid piece of iridium into more perfect shape by connecting one part of it with one wire of the battery (the positive), and working upon it by the disruptive discharge to the positive iridium electrode, as has been more particularly explained.

*Twelfth.* We claim in regard to the equaliser described: First, the use of a platinum wire of sufficient thinness, so arranged as to be immersible, more or less, in mercury, while the part out of the mercury is covered with water (certain other imperfectly conducting liquids, or liquid solutions, may be used instead of water, as alcohol or dilute sulphuric acid), so that the electric current, to be equalized thereby, being passed through the mercury, and the part of the wire that is above the surface of the mercury is thereby resisted and diminished more or less, according to the length of wire remaining above the mercury, which wire may be moved when required (by the human hand for instance) for the purpose of regulating, or increasing, or diminishing, the electric current. Second, the combination of the above apparatus with an electric regulator, such as described, so that the motion of the regulator shall make the wire to rise or fall in the mercury, and thus check and prevent any material variation in the quantity of the electric current circulating in the conductors with which this instrument is connected. Third, the application of self-acting rheostats to branch currents diverging from and re-joining a main conducting circuit, so that several lights can be maintained or operations performed by current electricity from one battery or main circuit, without the risk of variation or accident from one affecting the action of the others. And, fourth, we claim the substitution of a number of fine springs (platinum wire being the material preferred) to make contact with the moveable helix of fine platinum wire, in place of mercury, as a means of contact in the "equalizer."

*Thirteenth.* We claim the compensating dial-balance galvanometer described; that is to say, we do not claim the application of an electric coil with an iron rod moving in its centre, for the purposes of galvanometry; but we claim, the combination of the coil and iron centre, with the pinion working into the rack affixed to the iron centre, so as to indicate the motion of the iron centre by the rotation of the pinion or its connexions, for the purpose of measuring the power of the electric current. Also, the application of a partial counterpoise-weight, on a wheel or arm fixed to the spindle of the said pinion, the weight being of such amount and applied in a line with such part of the circumference of the pinion as shall have the most effect in making the spindle of the pinion to pass through more equal arcs than otherwise, when equal additions are made to the power of the electric current actually passing in circuit. Also, the application of the triode or appendage, by which a free electrically conducting connection can be made or broken at pleasure, between the conductors (such as the screw clamps) connected with the two ends of the conducting wire which is in the galvanometer. The object of the triode being to make a freer passage for the current than the galvanometer wire itself affords, when the galvanometer is not required to give its normal indications. We further claim the triode in its combination with quantity galvanometers, that is, with such galvanometers as

give a palpable indication of the change, when any resistance is added to or taken from the circuit of such electric currents as they are fitted to measure. And, finally, the combination of the triode with any intensity-galvanometer (that is, a galvanometer which gives palpable indication of the change when the electro-motive force of the current is increased or diminished) that may be preferred for use.

*Fourteenth.* We claim the differential galvanometer described, that is to say, the use of one or more lengths of insulated wire, in coils or otherwise, so arranged in connection with a quantity-galvanometer, that the coil of wire can be included in the circuit, or the circuit completed without it, at pleasure; as, for instance by turning set screws for the purpose of obtaining an indication of the intensity (or electromotive force) of the current, by observing the quantitative indication of the galvanometer, with and without the said wire being included in the current. We also claim the arrangement of wire when used to form a partial resistance to an electric current in a coil, having the reversed windings, or having the flat form, as hereinbefore described, for the purpose of neutralizing the electromagnetic effects of the current in the said coil.

*Fifteenth.* We claim, in respect of the improved lamp movement described, First, the use of a screwed and slotted electrode shaft, with a wheel screwed on it, the whole being so arranged that the revolution of the wheel shall cause a longitudinal motion of the shaft. Second, the use of a spring support for the said wheel, or for the support of the shaft, whereby the wheel sinks a little when the electrodes are brought tightly into contact, and in sinking its teeth shall meet a stop to arrest its further motion, so as to prevent too great a pressure on the electrodes, as explained. Third, the combination of an elastic head, with the moving centre of the regulator; and, Fourth, the use of a chain and barrel, in place of a rack and pinion, for supporting and imparting motion to the electrode shaft, in certain electric lamps, as has been fully explained, with the special advantages attending it.

## ELECTRO-CHEMICAL PRINTING.

Sir,—A bold invasion of a patent right must be followed, if necessary, by a bold attempt at justification. This is only human nature, and can excite but little surprise. Still, I must say I was astonished at the tone assumed by Mr. Alexander Bain in his recent attempt to repel the charge of piracy brought by me against him in No. 1386 of the *Mech. Mag.* He absolutely comes forward as a deeply injured man. "Alas!" he exclaims, "it is the universal lot of inventors, so soon as their labours are crowned with success, to be beset by a host of pirates and pretenders to priority of invention!"

Have I ever pirated anything belonging to Mr. Bain? If so, pray let us hear what it is; and if not, why does he introduce the word at all as an element of recrimination in his *reply to me?* Is there so little justice in his cause that he must resort to groundless insinuation? He talks and vapours about his own achievements, and about my *spurious* and *imaginary* claims. I will only say, in return, that I have read and re-read my specification very carefully, and I have also read Mr. Davy's. I am quite satisfied with the result; and, as I hope one day to have an opportunity of trying the legality of Mr. Bain's proceedings in a court of law, it is not, of course, my intention on the present occasion to prestate the case. I will, however, reply to some few of his observations.

He says, "There is not, either in the patents of Mr. Davy or Mr. Baggs, any chemical solution available for the purposes of rapid telegraphic communication;" and, as far as I am concerned in the matter, he attempts to prove this by quoting from *a faithful abstract* of my patent specification. We all know that abstracts of patent specifications, though necessarily circumscribed, are most useful to the general reader as a *key* to the progress of applied science. Here their utility terminates; and who, but a sophistical reasoner, would dream of introducing the mere *abstract* of a specification as *evidence* in a matter of contested piracy? Mr. Bain, however, does this; and he gives from such *abstract* the following account of my method of procedure:—"Patterns were formed by pieces of different metals, and placed upon cloth or paper moistened with a solution of carbonate of soda, which received coloured marks from the metals when a galvanic current passed through them." Here Mr. Bain comes to a dead stop! Now, if any one will turn to my patent specification, he will find, immediately after the above description, the following sentence:—"By substituting *ferrocyanate of potassa*, or any other appropriate

solution, for the carbonate of soda, a different set of colours is obtained." Why was this important passage passed over in silence? First, because it did not occur in the "*faithful abstract;*" and secondly, because *ferrocyanate of potassa* (common prussiate of potash) is *the very salt* with which the "chemically-prepared paper" has always been impregnated to receive the communication in Mr. Bain's electro-chemical printing telegraph.

For further particulars, inquire at the Electric Telegraph Station, Lothbury!

So much, then, for Mr. Bain's statement concerning my patent, and what he describes as my chemical solution. But he goes even beyond this. He endeavours to wrest all credit, right, and title whatever out of my hands, as will appear from the following sentence:—"On making inquiry, however, I found that the principle of electro-magnetic decomposition had been applied to telegraphs, and actually patented, two years before, by Mr. Davy." Notwithstanding this, poor Davy receives no more mercy at his hands than myself. He expresses himself perfectly independent of both of us—says he has discovered far more suitable solutions for the purpose, and that he has "effectually overcome all the difficulties that stood in the way of rapid telegraphic communications by electro-chemical decomposition." Mr. Bain understands, or ought to understand, some little of the patent law by this time. What does he say to the second claim in *Mr. Davy's specification*, which I now quote verbatim, "Secondly—*I claim the employment of suitably-prepared fabrics for receiving marks by the action of electric currents for recording telegraphic signals, signs, or communications, whether the same be used with the apparatus above described or otherwise.*" Now the question is (for Mr. Davy's patent has yet three years to run) how is the matter of the above claim "patented to the world?" To whom are we indebted for the previous applications of this principle to telegraphic purposes? I must now pause for a reply.

I am, Sir, yours, &c.,

ISHAM J. BAGGS.

CEMENT BUILDING.

Sir Samuel Bentham having ascertained that the cement manufactured in Sheerness dock-yard was stronger than the best bricks, (*Mech. Mag.* No. 1,300, p. 33,) and that it could be furnished at a very low price, was preparing to compose with it an artificial stone for the ornamental parts of buildings in naval arsenals, and the following note of further economical uses that might be made of that material has been found amongst the many MSS. he left.

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*Cement Building.*

If cement can be made at 8d. or 9d. as it appears, or even were it at 1s. per foot cube, there seems no need of using brick or even stone so cheap as ragstone, while shingle or even sand is to be had cheaper. Buildings might be erected by means of temporary wooden supports, to keep up the cement in the form of grout while setting,—or very thin plates of cement may be set up on edge for the inside as well as for the outside of the walls, and the intermediate space filled in with the cheapest materials and cement in grout. In this case these covering plates might be formed with more or less extra work for beauty, as well as for more effectually keeping out water or resisting injury from percussion.

For floors and roofing they should be formed in pieces not too large to be moved to the spot, or perhaps the entire floor for each room might be made on the ground, directly under, and hoisted up, or on a stage at or above the proper height; the straight lower edges of the parts serving as bearers: or ties might be of wood, covered with the cement, as stronger to resist a pull. These wooden ties might be made in the first instance to support the floor composed of parts, till by the casing-in of the lower part with cement plaister the whole be combined into one solid mass. Or flat ceiling may be added, so as to strengthen the tie, and formed either of plates of cement or by laths extending all across, supported at the middle and other intermediate places, and then plaistered over as at present.

Looking upon cement, whether of lime or of Parker's, or any other calcareous composition, or even burnt clay, as very strong against compression, but compara-

tively very weak as against tension, it seems better to employ such material for the arch, and upper edges of the parts, such as beams and girders, where the strength depends on resisting compression, but to substitute wood or iron for the part which acts as a tie to resist the tendency to separate; yet these ties may be covered completely with the cement.

If the depth allowed to be taken up by the floor, be sufficient to do without ties of other material, the floor and ceiling together may be formed of *hollow* masses, the front row stuck against the wall, and each successive row stuck against its preceding one, with indenture to tie together the lower edge, as well as being put together with cement.

So *hollow* walls might be built in the same way, provided the substance be sufficient for strength; this is preferable, as a worse conductor of heat than a solid wall. If built with plates, as before mentioned, and filled in solid with cheaper grout, the plates for the inside of rooms might be made with the greatest possible preparation of sawdust or other bad conducting substance.

For roofs, the hollow masses put together to form the arch might be so contrived as to afford a second passage for water between the floor of the roof and the ceiling of the room under it; this passage might also serve as a cistern.

The outside plates might be for the basement of a building *rusticated*, and for the other parts champhered, showing each stone—this for ornament only; but it need add but little to the expense, as the inside of the plates might be hollowed out accordingly.

## DICKER'S APPARATUS FOR TRANSFERRING MAIL BAGS AT FULL SPEED.

Sir,—It is curious to observe the almost innumerable necessities and inventions called into existence by the introduction of railways. The idea of safely, and with certainty, taking up and putting down the mail bags at the various stations on the line, without checking the speed of the train—though that speed might be some forty or fifty miles an hour—did not enter the imagination until railways had been long in successful operation. Even after the idea had been conceived, the best mode of carrying it into practical operation was not immediately hit upon.

Experience has at length shown that the plan of Mr. John Dicker, inspector of mails, accomplishes this desirable object in a manner that leaves nothing more to be desired. His plan, like most other good ones, is exceedingly simple, as will be apparent from the following explanation: Fig. 1 is a plan of a mail receiving and delivering station, with the Post-office carriage about to put down one bag and take up another. A is the carriage proceeding in the direction of the arrow, to which a receiving-net E, and delivering apparatus D, are attached. B is an upright standard at the side of a line of railway, on which the bag to be taken up is suspended in a leather envelope for delivery into the net E attached to the carriage. C is a stationary receiving-net attached to a wooden frame placed as near the standard B as possible, in a direct line either before or after, as shown. D is an apparatus attached to the side of the carriage, with locks constructed to hold the bags (when put out for delivery) until the carriage reaches the net C on the line; this arm or apparatus is drawn up to the side of the carriage by means of a balance weight inside, as soon as it is relieved of the bag; the strength of the spring locks must be governed by the weight and bulk of the bags; and when they vary much in this respect, two of these arms should be fixed close to each other, are to be used for ordinary weights, the other for heavy bags. A similar apparatus is also attached to the standard B, which delivers the bags into the net E, which is constructed to slide in more or less, to allow for the variation of the rails, and is kept in its position by a screw on the top of the standard. Fig. 2 is a plan of the net on an enlarged scale, showing the detaching lines G, covered with leather, for the purpose of liberating the bags from the standard B, and the apparatus D on the side of the carriage; these lines are of great importance, the acute angle being the part in which the bag is griped to detach it from the locks. Fig. 3 is an end elevation of the hinder part of so much of the carriage as is necessary to show the position of the receiving nets, &c.

Mr. Dicker's plan has been for some

Fig. 1.

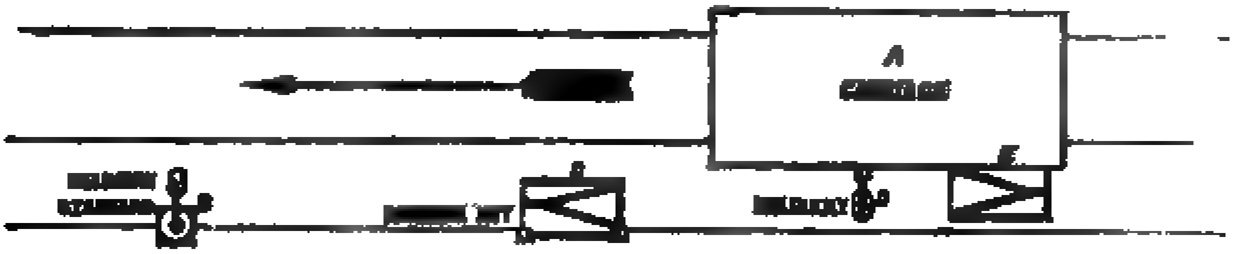



Fig. 2.

Fig. 3.

time in full operation on the South Eastern Railway with unvarying success, and is now being adopted on the London and North Western. It will also, probably, be immediately applied to the French railways, a working model of the apparatus having been furnished to the French authorities by the English Postmaster-General; a proceeding that is much to be regretted, as it precludes Mr. Dicker from patenting his invention in France.

Although Mr. Dicker has, without fee or reward, given his employers *here* the full benefit of his skill and ingenuity, I think they are hardly justified in thus appropriating and giving away his rights in foreign countries, where he should be at liberty to reap the benefits of his inventive talents.

I am, Sir, yours, &c.,

WM. BADDELEY.

29, Alfred-street, Islington, February 7, 1850.

## ON THE CAUSES OF THE EXPLOSION OF STEAM BOILERS AND OF SOME NEWLY-DISCOVERED PROPERTIES OF HEAT. BY MR. JAMES FROST, OF BROOKLYN, NEW YORK.

(Continued from page 233.)

This experiment with fusible metal would have been conclusive of the true and full rate of expansion from 212° to 650°, were it not for a very unexpected contingency, though the metal was completely fusible at 210° at commencement of experiment, yet at its termination the metal became so sluggish and pasty at 218° that no lower temperature could be profitably observed thereby.

We attempted to discover whether the cause of this anomoly might not be found in the escape of some volatile metallic matter from the initial compound metal, when subsequently heated to 650°, by heating a small quantity of fresh metal from 60° to 650° within a long, open, cold glass tube, sealed at the lower end only; but as no metallic or other vapour was observed to condense therein, we are unacquainted with the cause of the lessened fluidity, for no metallic vapour was observed to condense in the long cold part of the tube, nor could any other visible alteration of the metal be discovered on cooling, but lessened fusibility at 220°.

We then experimented with a new No. 1 eudiometer, by moistening the interior short sealed end thereof with water, and supplying it with linseed oil instead of mercury used in our first experiment.

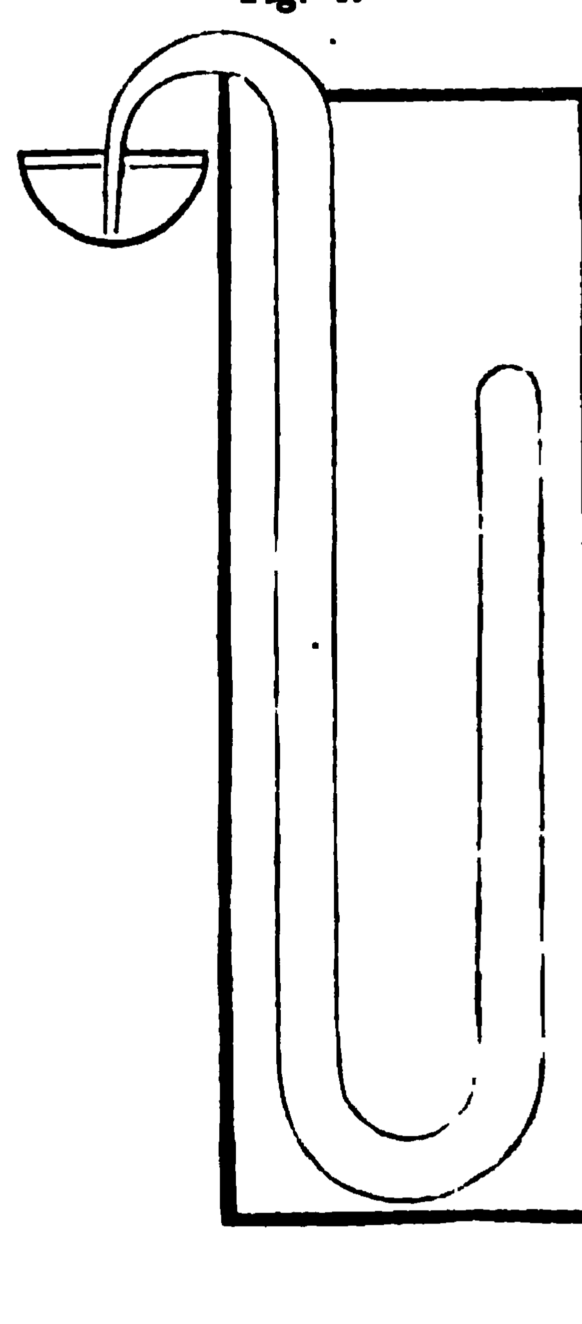
This eudiometer was very gradually heated along with a thermometer within a bath of linseed oil to 400°, during which operation the surperfluous water and steam were observed to evaporate. Soon after the instrument was heated above 212°, the apparatus being allowed to cool gradually, showed regular decrements of heat and volumes, corresponding to the behaviour of steam confined under fusible metal.

By only slightly varying the foregoing experiment, an unexpected an immense difference resulted, by merely putting the oil first into a dry eudiometer, and then putting a drop of water into the oil (of full one-tenth inch diameter). On heating the instrument in a bath to 300°, no portion of the water evaporated, nor was any alteration thereof visible at that great heat and little pressure when the instrument was withdrawn from the bath for inspection. At about 320°, small portions of the drop of water decrepitated like common salt upon hot coals. The crepitations increased in number and violence with increasing heat, till towards 340° the instrument was withdrawn to preserve it from destruction by the increased violence of the concussions; yet on looking into the instrument half the original drop of water still remained unaltered within the oil. This curious experiment first exhibits a combination of water and of heat under perfectly new views. We have here a small body of water, unmixable with oil, and unconfined at the time by little more than atmospheric pressure (one inch of linseed oil), prevented from its natural expansion into steam of more tension than four atmospheres, by mere immersion in linseed oil at 300°, and prevented by the same feeble mechanical means from total decrepitation, when sufficiently heated to form, in the natural way, steam of more tension than six atmospheres.

We therefore unquestionably have arrived at a stronger corresponding and corroborative instance of that obscure fact, observed when steam is heated in contact with mercury at temperatures between 238° and 250°, during which the natural expansion of steam seems to be suddenly arrested and wonderfully lessened, which influence acting with decreased effect, seems to vanish about 500°, and then commences to act with continually increasing effect to the highest temperatures reached in our experiments, 650°.

We have collected the results of former experiments into one table, reduced to one scale for easy comparison.

Fig. 4.

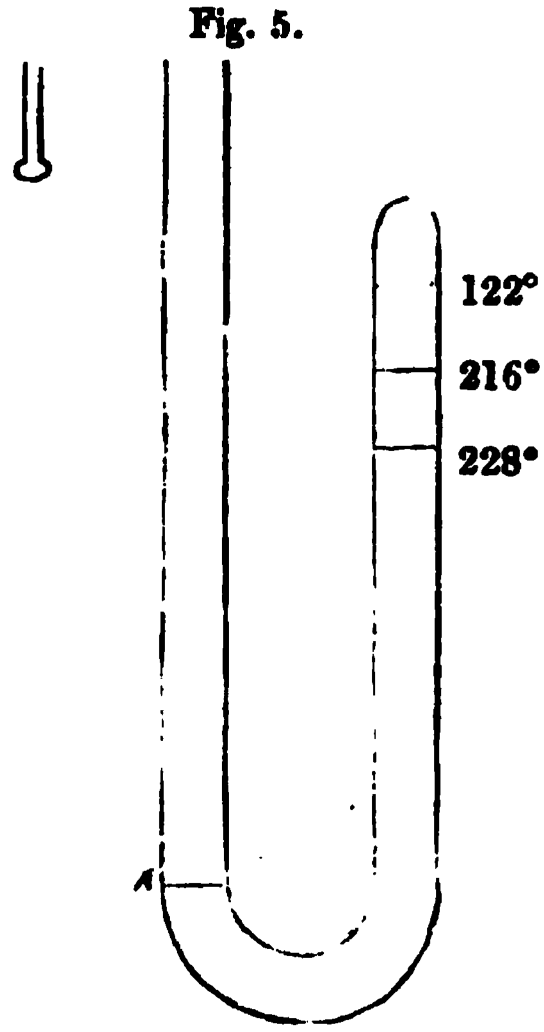


A variation of the foregoing curious experiment will be found below. The accompanying diagram, fig. 4, represents one of several similar glass eudiometers, each one being completely filled with well boiled water only, as placed within a bath of fusible metal, and gradually heated therein to 650°, thus the water was expelled therefrom into a cup, till the eudiometer contained only stame, when, the cup being withdrawn, the small open end of the eudiometer was sealed (while hot) with a blow pipe flame, and when the instrument was cooled, the interior thereof constituted an engineer's vacuum, containing only the equivalent or basic water due to the volume of stame the instrument had contained.

On one of these instruments being immersed in a fluid, while the small sealed end thereof was held at some distance below the surface of that fluid, the sealed end was broken off, and the instrument became instantaneously filled with the fluid in which it was immersed.

The first instrument being filled with dry mercury, as much of that metal was poured out from the unsealed end, as reduced the surface within that end to letter A, fig. 5; the instrument being then heated in a bath,

Fig. 5.




the volumes of steam became apparent in the sealed end, in correspondence with the temperatures annexed thereto, showing that the volumes were proportional to those before obtained in other instruments at high temperatures, and that the very minute quantity of water still retained all its original properties, and therefore the water had been at high temperatures unaltered by contact with the mercury in those larger instruments.

The second instrument having been, in the same manner, filled with spirits of turpentine, no vapour was perceptible therein, till the instrument was heated to 316°, or boiling point of oil of turpentine.

The third instrument being treated in a similar manner with linseed oil, no vapour was perceived therein even when heated to 400°.

The foregoing experiments seem to clearly show, that while mercury possesses no overpowering attraction for water in a very minutely divided state, or sufficient to hinder the formation of natural steam therefrom, yet on the contrary, both the oils of linseed and turpentine, when similarly circumstanced, possess such very powerful hindrances thereto, that spirits of turpentine prevents the formation of steam from water at 316°, which at that temperature would have a tension of more than 60 lbs. per inch, and linseed oil prevents the formation of steam from water at 400°., which at that temperature would possess the tension of more than 260 lbs. per inch.

Now this fixity of water so heated is strongly contrasted with a circumstance I have often witnessed, but never seen recorded. On withdrawing atmospheric pressure, by means of a very superior air-pump, from well boiled cold fixed oils, the oil is resolved at common temperatures into black vapour or smoke, just as long as the perfect action of the air-pump is continued.

The foregoing experiment seems to indicate that the joint attraction of the compound chemical equivalents of oil for small quantities of water, is far superior at high temperatures and under atmospheric pressure, to the separate attraction of the chemical equivalents of oil for each other at common temperatures, when released from atmospheric pressure: so that were there no atmospheric pressure, there could be no fixed oils, just as if there were no atmospheric pressure there would be no water at common temperatures.

To test the real value of the foregoing matters practically in some degree, two small working high-pressure engines were carefully constructed and both exactly alike in every particular, except that the diameter of one cylinder of 6 inches was double the diameter of the other cylinder of 3 inches, and therefore of fourfold capacity.

These engines were alternately supplied with steam of the same tension, through separate pipes furnished with stop-cocks, and attached to the same tubular boiler over the same furnace, wherein the same quantity of fuel was consumed in the same time in both experiments.

Within the furnace, above the fire and beneath the boiler, was placed a coil of iron pipe to heat the steam in its passage from the boiler to the larger cylindered engine; the heating surface of this coil being equal to about one-fifth part of the heating surface of the tubular boiler. Each engine was furnished with a meter to number the revolutions thereof, and with one of Morin's dynometers for measuring and recording the actual working force or duty of the engine, at every instant of the experiment.

Experiments were made and separately repeated with these engines, in presence of highly respectable and competent engineers, when it was found, when the engines were successively run at the same speed, that the same quantity of fuel produced more than four times greater effect, when the steam employed in the larger cylinder was heated in its passage thereto through the heated coil of pipes, than a similar quantity of fuel produced in the smaller engine with the unheated or natural steam of the same exact tension; while in both cases all the steam the boiler could supply was employed. The inference then seems unquestionable, that more than four volumes of elastic fluid of equal tension was producéd from the same fuel, and effectively employed in one case than was produced in the other case, and from a similar quantity of water also. For it is evident, that as a part of the heat in one case was intercepted in its passage from the furnace to the boiler, by the coil of iron pipe employed to heat the steam in its passage to the larger engine, much less heat could only then be employed to convert the water to steam in the boiler, and therefore there must of necessity have been less water evaporated therefrom during that experiment.

As it appears in the diagrams how comparatively great is the initial expansion of steam by heat, which initial expansion is unused, wasted, and cannot be employed in high-pressure engines, it as evidently follows, though high-pressure engines are thus capable of immense improvement, yet in their very nature they are incapable to obtain the full advantage of this improvement, and can dispense but a portion of the benefits to be derived from this discovery, by which the power of mankind over matter may be so inexpensively and so immensely increased.

The wonderfully, nay, we must say, the miraculously distinctive and peculiar qualities of either or both these elastic fluids, in equal volumes of equal tension and equal mercantile value, will be found collected in the following table, and must fill the mind with astonishment:

| *Steam* | *Stame* | Each under atmospheric pressure or tension. |
|---|---|---|
| 8 | 1 | Equivalents of water. |
| 8 | 1 | Equivalents of caloric. |
| 12 | 24 | Distances of and in di- |

mension of the diameters of atoms of water from each other at the tension of 30 inches mercury, assuming the distances probable, from the general laws of atomic combination and our previous calculation, which shows that while water is increased 1,700 fold in steam, it is increased 13,600 fold in stame under atmospheric pressure, and by the same quantity of caloric at the temperature of 650°.

To the foregoing miraculous distinctions we have to add another equally curious and distinct affinity discovered to exist between caloric and water in stame, and which new property alone would constitute stame an atomic chemical compound distinct from steam, were there no other distinction whatever between them, and which peculiar property of stame must hereafter prove of great value in many economical applications of heat.

To comprehend this new and useful fact, it is necessary to recollect the temperature of steam is always found to be in strict accordance with its density; Tables whereof have been published by Taylor, Dalton, Ure, and by many others; and it is therefore well known, that however high may have been the temperature of the steam employed in any engine, the temperature will be instantly reduced to that of atmospheric steam employed in any engine, if allowed to escape and freely expand under atmospheric pressure only, whilst within and passing through a sufficient exhaust pipe. But the behaviour of stame, under the same circumstances, is so different from steam, as to prove that caloric and water must have entered into some further, stricter, and far more peculiar relations in stame, unknown in and incompatible with those of steam.

To show this clearly, we have collated in a table the different states observed in those different elastic fluids, each freely escaping from working high-pressure engines. The initial density of steam in the boiler was made to differ so greatly to render the experiment more striking and instructive; for by this arrangement there was actually double the incipient caloric in every equal volume of steam of six and a half atmospheres, than in an equal volume of stame of two and a half atmospheres, notwithstanding the stame had been heated out of contact with water to 612°.

Each experiment lasted half an hour, during which the exhaust steam and stame were respectively conducted from its appro-

priate working engine through two feet of exhaust pipe into the upper part of separate, inverted, large red garden pots, imbedded in and covered with dry sand, the expanded elastic fluids were allowed to escape freely from the lower end of the pots, through a continuation of sufficient exhaust pipes, so that within the pots there could be scarcely more than atmospheric pressure. Within each was introduced the bulb of a thermometer, and also about half a pound of dough to be cooked by the exhaust steam or stame, when the following results were obtained:—

| | Density of steam in boilers, in atmospheres. | Temperature of steam in boilers. | Temperature of stame in engine. | Temperature within pots. | Different states of dough when taken from pots. | |
|---|---|---|---|---|---|---|
| | | | | | Substance. | Surface. |
| Steam | 6·5 | 321° | | 216° | Tender. | White glistening. |
| Stame | 2·5 | 264° | 612° | 550° | Hard crust. | Charred black. |

As several important inferences can be better drawn at the fitting opportunities than at present from the foregoing facts, we will therefore now proceed to show some other properties of stame deserving attention; and first, the great celerity with which steam takes up heat by contact with metallic surfaces, and becomes stame, is incomparably greater than the speed with which water takes up heat and becomes steam, and probably is equal to the speed with which steam imparts heat to any colder substance by contact therewith, and which property of steam appears to be limited in velocity only by the conducting capacity of the substance in contact; for by calculating the respective capacities of the cylinder and of the heating coil of pipes, and speed of piston, it was apparent, though the stame was continuously increased in temperature 400° above the temperature of the steam from which it was produced, yet every volume thereof passed through the heated coil in less than the third part of a second.

This celerity of transformation of steam into stame of greater volume, combined with the little quantity of caloric required for the transformation, compared with the great quantity both of caloric and of time required for the formation from water for a small volume of steam of equal tension, if these considerations are compared with the well known slow evaporation of water from unduly or "greatly heated" surfaces of metal (elaborately set forth in the Franklin Institute experiments), these joint considerations would show how much more probable, as well as how incalculably more sudden, certain, and powerful agent for mischief is stame than steam.

But as we are also well assured that stame parts with its heat instantaneously to any colder substance in contact, we may now from these premises understand how a sudden abstraction of steam from a boiler may cause an explosion, that might not have occurred under the same circumstances, without such sudden abstraction; and it is easy to imagine such circumstances may have occurred when a boiler has exploded soon after an engine has been started that had been temporarily stopped for a short period, as for transfer of passengers and goods at a wharf, which unhappily is by no means a rare occurrence.

During such a period, the engine being inactive, the cylinder becomes cooler—the pumps being inactive, the water becomes deficient in boilers—lower portions of the boilers become uncovered with water and overheated; the steam in contact with those portions becomes overheated also, and then as quickly transports the heat from lower to upper parts of boilers.

Now as the tension of steam in boilers would be little affected by this transfer of heat within the boiler, the usual discharge from the safety-valve would be so little affected thereby as to appear satisfactory to the engineer, and as the engine had previously worked satisfactorily, no danger would be apprehended, though the boiler was then preparing for and approaching the very verge of explosion.

The frequent records of such calamities have often shown that the explosions seldom or never occur, while the steam is at its greatest tension, nor till "the engine has made a few strokes," or till "the boat has got one or more lengths from the wharf," when, if, at all, an explosion ensues.

Now, if these frequently occurring circumstances be fully considered, it will appear, that with free acting safety-valves the greatest tension of the steam must have existed previous to starting the engine, for as the tension of steam cannot be sustained an instant in contact with any substance colder than itself, on starting the engine the cooled cylinder must be heated with rarefied steam, which will consume or use up several volumes of steam beyond the volume required for filling the cylinder when heated, while for heating the cylinder there will be required many more volumes of stame than of natural steam, proportionate to the very

different actual quantities of caloric contained in those different compounds of water and heat. The tension of steam in boilers so circumstanced, must therefore be for some time rapidly reduced at every stroke of the engine, till an explosion ensues, if at all, from some unknown cause under lesser tension.

Now this occult cause may be explained. The rapid abstraction of rarefied steam from the boiler suddenly lowers the pressure upon the heated water in the boiler, and a portion of that heated water as suddenly flashes into natural or dense steam, which is as suddenly transformed by contact with the extensive heated surface of boiler into a volume of stame, of such greater magnitude and tension, that the safety-valves cannot discharge nor the boilers retain, and explosion necessarily occurs, and hence there may be seen, how the opening of large safety-valves, or the fusion of large metallic substitutes for valves, may, under such particular circumstances, occasion the direful catastrophes they were specially constructed to prevent, for it is evident the more rapidly the stame is discharged from boiler, the more suddenly and perfectly will the consecutive changes just enumerated take place.

In our description of experiments with a high-pressure boiler, we anticipated greater profit from converting low steam than high steam to stame of the same temperature, because of the greater degree of expansion to which it is subjected, and which we have now found experimentally to be true. For we connected a small condensing engine by separate pipes and stop-cocks, with a boiler and steam-heater attached thereto, whereby the engine was worked for an hour alternately with steam or with stame, the steam being always of the same uniform tension in the boiler, as the safety-valve was loaded uniformly with 15 lbs. per inch, and the steam always blowing off from the safety-valve, was of the uniform density of 30 pounds per inch within the boiler during every experiment.

The vacuum in the engine was measured by a mercurial gauge, and produced and maintained by causing the exhaust steam or stame to pass respectively through a long coil of metal pipe placed within and on the bottom of a large cistern filled with cold water, whereby the steam or stame was condensed into water in its passage to the air-pump, situated in a small cistern near the engine, and into which the cold condensed water was delivered after the heat had been separated therefrom and retained in the water in the large cistern, whereby and wherein the proportionate quantity of heat absolutely employed and expended for working the engine in each separate experiment, became both readily and accurately ascertainable.

By employing this apparatus we observed two distinct results or general laws:

First, we found that the hotter the steam was heated in its passage to the engine, the less was the heat imparted in the same time to the water in the condensing cistern.

Secondly, we also found the hotter the steam was heated in its passage to the engine, the more effective and powerful the engine became, till this increased effect amounted to a very considerable per centage. This fact was very plainly shown by the dynameter attached to the engine, which was maintained at the same speed, and although the heated steam had to pass through a heated spiral coil of pipe of somewhat less diameter, and of ten times the length of the shorter direct pipe, through which the unheated natural steam was conducted to the engine.

This fact can only be accounted for by the far rarer fluid stame moving with greater celerity under the same pressure as the denser fluid steam, and this one fact establishes another, that stame is a vastly rarer fluid than steam.

Thus the efficiency of the first was found in different experiments, in just proportions as the stame was heated beyond the temperature of natural steam, till we found it about six times as effective. To do this, however, we are obliged to substitute a heater with a larger proportionate heating surface than one-fifth the heating surface of the boiler as employed in the previous experiments with high steam; and we have no doubt, that with a larger proportionate surface of heater than we have yet employed, the efficiency of fuel may be further increased by using stame of a higher temperature, as the experiments hitherto made coincide very satisfactorily with the general proportions found by the different eudiometers, distilling apparatus, and deductions therefrom.

Now the extraordinary discrepancy between the learned chemists who stated it requires 480° of heat to double a volume of steam, and our experiment showing that four degrees of heat doubles, and sixteen degrees of heat trebles the volume of steam, is easily accounted for, as it is merely the difference between a seemingly well-grounded theory of learned men and an absolute fact discovered by experiment. For those philosophers having found that it required 480° of heat to double the volume of all the different gases, and as oxygen and hydrogen gases among the number are composed of all the elements contained in steam, namely,

oxygen, hydrogen, and heat, they theoretically inferred (per saltum) that steam and all vapours were subject to the same law of expansion, which is now shown to have been one of the most unfortunately learned guesses to be found on record. A further examination of the peculiar properties of steam, and the elements of which it is composed, exhibit such irreconcilable distinctions, as all the theories philosophers have coined for explaining the nature of heat and its combinations with ponderable matter, will utterly fail to explain.

(*To be continued*,)

### THE APPLICATION OF THE SCREW TO NAVIGATION.

Sir,—Should the following fact be admissible into your excellent publication, I shall be much gratified and obliged by its insertion. I add my name and address for your satisfaction, but I do not wish them published.

I am, Sir, yours, &c.,
* * *

February 28th, 1850.

Mr. Editor,—Some years since, there was an inquiry in one of the newspapers, as to who was the person that first suggested the Archimedean screw, for the purpose of propelling vessels at sea. That person was Samuel Mellish, of Gray's-inn, who died in 1828. In the year 1824, he called on me with a drawing, showing the manner of applying the screw, and which he proposed should be worked by the capstan, for the purpose of propelling the vessel during a calm. This drawing is now in my possession, and I shall be happy to show it to you. I observed to him, that I thought the screw would not produce the desired effect. Whethis remark discouraged him, I cannot say; but I heard no more on the subject. He was one of the original proprietors of the Royal Institution, and being very communicative, I think it is probable that he might have mentioned the idea to some one there.

About forty years ago, he invented a mode of distributing grape shot from a field piece, in a line, instead of in a circle. This invention was shown to the Secretary of the Duke of York (a Colonel somebody), who treated it lightly. He afterwards submitted it to the Board of Ordnance. One old general officer observed, that "if such a machine were brought into use, it would soon put an end to war." He received very little encouragement from the Board; and after some conversation, he was desired to leave the model. This he refused to do, and he heard no more on the subject. I have understood that these officials are desired to obtain all possible information respecting any invention that may be laid before them, but never to encourage the inventor. And this seems to be true, for I am informed that there is a precisely similar model in the Arsenal at Woolwich, and one also in the Musée D'Artillerie in Paris, copied, no doubt, from the one at Woolwich, and which was the invention of Samuel Mellish.

I am, Sir, yours, &c.,
VERITAS.

### BREAK DOWN OF THE PRIZE SYSTEM FOR THE EXHIBITION OF 1851.

We are glad to perceive, from an official announcement of the Commissioners, that the plan of granting money prizes is now virtually abandoned. The Royal Commission, it will be remembered, proceeded on the distinct assumption that 20,000*l*. was to be awarded in prizes; and it was afterwards given out that there would be one grand prize of 5,000*l*., and four others of 1,000*l*. each. The Commissioners, however, now say that "they have resolved to take immediate steps for having *medals* struck of various sizes and different designs—it being their opinion that *this is the form* in which it will, generally speaking, BE MOST DESIRABLE *that the rewards should be distributed*." They desire, at the same time, that it should be understood that, "in announcing their intention of giving medal prizes, they do not propose ALTOGETHER *to exclude pecuniary grants*, either as prizes to successful competitors, or as awards *under special circumstances accompanying*, *and in addition to the honorary distinction of the medal*," &c., &c., &c. There may be cases, &c.; in short, "the Commissioners are not prepared, *for the present*, *at least*, to establish any regulations on these heads."

### PRETERRE'S PATENT TEA AND COFFEE POTS.—(SEE ANTE, P. 220.)

1. The improved tea or coffee pot consists of an open vessel in which the tea or coffee is placed, and of a closed boiler suspended at one end of a weighted lever above a lamp. One of the legs of a syphon, with a

strainer affixed to it, is placed in the vessel, and the other leg in the boiler. The lamp is lighted, and as the steam is generated the water will be gradually forced from the boiler up the syphon into the vessel, where the infusion will take place, until the weight of the boiler is thereby reduced to allow the weight on the lever to act and lift it up, when a cover, provided for that purpose, will fall down upon the lamp and extinguish it. As soon as the steam in the boiler condenses, the infusion will return to it, in consequence of the unbalanced pressure of the atmosphere in the vessel, and will at the same time be filtered. The infusion may be afterwards drawn off as required by a tap fitted to the lower part of the boiler.

2. The cooking apparatus is composed of a vessel filled with water, in which is placed a charcoal fire-place and a boiler. An oven is placed above the fire-place, and a set of saucepans above the boiler, which are heated by steam.

3. The improvements in roasting coffee consists in suspending the roasting cylinder in one end of a lever, weighted in such manner, that when the coffee has arrived at a certain roasting point, that is, has lost a determinate portion of its weight, the cylinder shall be lifted up.

4. The improvements in grinding consists in applying a collar and nut to the driving axle, for the purpose of regulating the distance between the grinding surfaces, and, consequently, of regulating the degree of fineness to which the coffee is to be ground.

## CHAMROY'S PATENT HELICAL RAILWAY.

(SEE ANTE, P. 220.)

The patentee proposes to lift loads, or water in mines, and to apply the same principle to lift railway carriages from one line of rails to another on a higher level. For this purpose, a line of rails is arranged in a helical manner in the shaft of the pit, on which runs a platform on three wheels fixed at different levels. A vertical grooved shaft passes through the centre of this platform from the top to the bottom of the shaft of the mine, and receives rotary motion from any prime mover. The platform is furnished with a bolt which may be slidden into the groove in the shaft, and a rotary motion thereby imparted to it. Upon the platform rest the wheels of another one, which is fitted with guides that embrace rollers fixed to the sides of the pit, and thereby prevent its revolving. And upon this second platform is placed the load to be lifted. On rotary motion being given to the vertical shaft, the under carriage will also revolve, and travel up the helical railway. By reversing the motion of the shaft the loads will be lowered.

Instead of the preceding arrangement, it is proposed to place a number of rollers, arranged in a helical direction, in the shaft of the mine, over which travels a helical projection on the periphery of a cylindrical carriage, which is moved up or down a rotary shaft in the same manner as the second platform first described.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MARCH 28TH, 1850.

WILLIAM BOGGETT, of St. Martin's-lane, manufacturer. *For improvements in heating and evaporating fluids.* Patent dated September 27, 1849.

A large portion of the improvements embraced under this patent relates to the construction of gas stoves, the objections which have so long retarded the adoption of which, they seem well calculated to remove. A number of stoves, on Mr. Boggett's plan of construction, are figured and described in the first article of our present Number. The nature of the remaining improvements specified by Mr. Boggett will be gathered from the claims, which are as follows:

*Claims.*—6. The construction of ovens with the top and bottom sides composed of corrugated or fluted plates, containing in the corrugations or flutes thereof pipes for the circulation of steam or hot air, and also a modification thereof.

7. The employment for heating and evaporating purposes of cells or vessels permanently filled with heated water or other fluid, or metallic alloys in a fluent state, in the manner described.

8. The employment in steam boilers of flues, having short cross tubes open at both ends.

9. The construction of the flues or tubes of steam boilers and other heating apparatuses with an internal lining of fire clay, or with internal division pieces of fire clay.

10. A peculiar construction of steam or hot-water tubes.

11. Peculiar modes of heating of steam boilers by gas.

12. The employment for heating and evaporating purposes of a combination of hydrogen, or carburetted hydrogen gas, in a cold or heated state, with heated atmospheric air, or with heated atmospheric air and lime; also the combination of heated oxygen gas with hydrogen gas, either cold or heated.

[In consequence of being obliged to publish on Thursday, instead of Friday, as usual, we are compelled to postpone giving the Abstracts of the rest of the Specifications enrolled on the 27th inst. until next week.]

## WEEKLY LIST OF NEW ENGLISH PATENTS.

John Stevenson, of Roan Mills, Dungannon, County Tyrone, flax spinner, for certain improvements in machinery for spinning flax and other substances. March 23; six months.

William Sykes, of York-street, Middlesex, tallow-chandler, for certain improvements in the manufacture of candles and wicks. March 23; six months.

John Varley and Joseph Hacking, of Bury, Lancaster, engineers, for certain improvements in steam engines and apparatus connected therewith. March 23; six months.

Henry Robert Ramsbotham, of Bradford, York, manufacturer, and William Brown, of the same place, mechanic, for improvements in preparing and combing wool. March 23; six months.

William Joseph Curtis, of Port of Spain, in the Island of Trinidad, in the West Indies, civil engineer, for improved machinery and apparatus adapted for the manufacture of sugar. March 23; six months.

Horatio Carter, of Thirza-place, Old Kent-road, Surrey, gentleman, for certain improvements in the production of light from ordinary coal gas, by the use of burners consisting of more than one ring or sheet of flame, combined with a suitable chimney or chimnies, and supplied with atmospheric air particularly adapted to ventilation. March 23; six months.

Joshua Siddeley, junior, brass founder, of Liverpool, Lancaster, for certain improvements in ships' fittings. March 23; six months.

Alfred Wilson, of Myddleton-street, Clerkenwell, Middlesex, clock-case maker, for an improved ventilator. March 23; six months.

John Gedge, of 4, Wellington-street, Strand, Middlesex, for improvements in lamps and candlesticks. (Being a communication.) March 23; six months.

Nathaniel Mathew, of Wern, Tremadoc, Carnarvon, quarry proprietor, for an apparatus for cutting or dressing slates into various shapes and sizes. March 23; two months.

Alfred Guillaume Roseleur, of Paris, France, but now of 4, South-street, Finsbury, Middlesex, chemist, for certain improvements in coating or covering metals with tin. March 23; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the preparation of materials for the production of a composition or compositions applicable to the manufacture of buttons, knife and razor handles, inkstands, door-knobs, and other articles where hardness, strength, and durability, are required. (Being a communication.) March 23; six months.

Edward Welch, of St. John's Wood, London, architect, for improvements in fire-places and flues, and in apparatus connected therewith. March 23; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in coupling joints for pipes. (Being a communication.) March 26; six months.

Thomas Dickason Rotch, of Drumlamford House, Ayr, North Britain, Esq., for improvements in separating various matters usually found combined in certain saccharine, saline, and ligneous substances. (Being a communication.) March 26; six months.

Evan Leigh, of Miles Platting, near Manchester, cotton spinner, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances. March 26; six months.

Joseph Theodore Clenchard, of Paris, France, manufacturing chemist, for certain improvements in the application of orchil to the processes of dyeing and printing in colours, and also an improved apparatus to be employed in the operation of dyeing. March 26; six months.

James Preece, Hereford, shoemaker, for certain improvements in mills and machinery applicable to the threshing and grinding of corn, the manufacture of cider, and other similar purposes. March 26; six months.

## LIST OF SCOTCH PATENTS FROM 22ND OF FEBRUARY TO 22ND MARCH, 1830.

Auguste Reinhard, of Leicester-street, Leicester-square, Middlesex, chemist, for improvements in preparing oils for lubricating purposes, and in apparatus for filtering oil and other liquids. Sealed, February 25: six months.

Onesiphore Pecquer, of Paris, civil engineer, for improvements in the manufacture of fishing nets and other net fabrics. February 25; six months.

James Young, of Manchester, Lancaster, manufacturing chemist, for improvements in the treatment of certain ores, and other matters containing metals, and in obtaining products therefrom. February 26; six months.

Alfred Vincent Newton, 66, Chancery-lane, Middlesex, mechanical draughtsman, for improvements in manufacturing leather. (Communication.) February 27; six months.

Eugene Ablon, of Panton-street, Haymarket, Middlesex, for improvements in increasing the draft in chimneys of locomotive and other engines. March 4; six months.

William Brown, of Airdrie, Lanarkshire, electrician, and William Williams the younger, of St. Dennis, Cornwall, gentleman, for improvements in electric and magnetic apparatus for indicating and communicating intelligence. March 4; six months.

Alexandre Hediard, of Paris, gentleman, for certain improvements in propelling. March 5; six months.

Thomas Richard, William Taylor, and James Wylde the Younger, all of Falcon Works, Walworth, Surrey, cotton manufacturers, for improved rollers, to be used in the manufacture of silk, cotton, woollen, and other fabrics. March 6; six months.

James Hill, of Stalybridge, Chester, cotton spinner, for improvements in or applicable to certain machines for preparing, spinning, and doubling cotton, wool, and other fibrous substances. March 6; six months.

John Fowler, jun., of Melksham, Wilts, engineer, for improvements in draining land. March 8; six months.

Gerard John De Witte, of Brook-street, Westminster, Middlesex, gentleman, for improvements in machinery apparatus, metallic, and other substances, for the purposes of letter-press and other printing. March 8; six months.

David Christie, of St. John's-place, Broughton, Salford, Lancaster, merchant, for improvements in machinery for preparing, assorting, straightening tearing, teasing, doubling, twisting, braiding, and weaving cotton, wool, and other fibrous substances (Communication.) March 13; four months.

Edward Ormerod, of Manchester, Lancaster, mechanical engineer, and Joseph Shepherd, of Chorlton-upon-Medlock, in the same county, mechanical engineer, for improvements in, or applicable to, apparatus for changing the position of carriages on railways. March 13; four months.

Frank Clark Hills, of Deptford, Kent, manufacturing chemist, for an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain salts. March 15; six months.

Warren De La Rue, Bunhill-row, Middlesex, for improvements in the manufacture of envelopes. March 20; six months.

William Handley, of Chiswell-street, Finsbury, confectioner; George Duncan, of Battersea, Surrey, engineer; and Alexander M'Glasham, of Long-acre, engineer, for improvements in the construction of railway breaks. March 20; six months.

## LIST OF IRISH PATENTS FROM 21ST OF FEBRUARY TO 19TH MARCH, 1850.

Joseph Stovel, of Suffolk-place, Pall-mall, East, Middlesex, tailor, for improvements in coats, parts of which improvements are applicable to sleeves of other garments. February 22; six months.

Lucien Vidie, of Paris, in France, but now of South-street, Finsbury, French Advocate, for improvements in conveyances on land and water. February 13; six months.

William Henry Phillips, of York-terrace, Camberwell, New-road, Surrey, engineer, for improvements in extinguishing fire, in the preparation of materials to be used for that purpose, and improvements to assist in saving life and property. February 26; six months.

James Higgins, of Salford, Lancaster, machine maker, and Thomas Schofield Whitworth, of Salford, mechanic, for certain improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, and similar fibrous materials. February 26; six months.

Auguste Reinhard, of Leicester-street, Leicester-square, Middlesex, chemist, for improvements in preparing oils, for lubricating purposes, and in apparatus for filtering oils and other liquids. February 26; six months.

Onesiphore Pecquer, of Paris, civil engineer, for certain improvements in the manufacture of fishing nets, and other net fabrics. February 27; six months.

Ernest Gaston, of the Erectheum Club, St. James', Middlesex, for certain improvements in artificial fuel, and in machinery used for manufacturing the same. March 1; six months.

Alexandre Hediard, of Paris, gentleman, for certain improvements in propelling. March 5; six months.

Alfred Vincent Newton, 66, Chancery-lane, Middl sex, mechanical draughtsman, for improvements in manufacturing leather. March 6; six months.

Thomas Marsden, of Salford, Lancaster, machine maker, for improvements in machinery for hackling, combing, or dressing flax, wool, and other fibrous substances. March 8; six months.

Henry Attwood, of Goodman's Fields, Middlesex, civil engineer, and John Renton, of Bromley, Middlesex, for certain improvements in the manufacture of starch, and other like articles of commerce from farinaceous and leguminous substances. March 12; six months.

James M'Donald, of Chester, coachmaker, for certain improvements in the method of applying oil or grease to wheels and axles, and to machinery, and in connecting the springs of wheel carriages with the axles or axle box. March 15; six months.

James Hill, of Stalybridge, Chester, for improvements in and applicable to certain machines for preparing, spinning, and doubling cotton, wool, and other fibrous substances. March 16; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| Mar. 21 | 2234 | Alexander Vaughan & John Hossack | Manchester | A self-acting lubricator or oil cup for shafts, spindles, or any similar objects revolving in a horizontal position. |
| ,, | 2235 | Frederick Augustus Dietrich | Bennett street, Blackfriars | An elastic hat lining. |
| ,, | 2236 | Samuel Collier | Reading | Junction pipe or hollow brick. |
| 22 | 2237 | James Lockhead, Frederick Sanders, and Charles Richardson | New Oxford-street | A ship's scuttle. |
| ,, | 2238 | Spilsbury and Downes | Huggin-lane, Cheapside | Fastening for articles of dress. |
| ,, | 2239 | Christopher Halliman | Kensington | A fruit protector. |

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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Edited by J. C. Robertson, 166, Fleet-street.


## MESSRS. STAITE AND PETRIE'S IMPROVED ELECTRIC LAMP.

Fig. 1.

Fig. 2.

MESSRS. STAITE AND PETRIE'S IMPROVED ELECTRIC LAMP.

(*See ante, p.* 246.)

We now lay before our readers the description given by the patentees of the Improved Electric Lamp Movement, which forms the subject of their fifteenth claim. We give the first place to this branch of their specification, because of the very general curiosity which prevails, to know the further improvements by which the recent exhibitions of electric lighting by the patentees, have so much exceeded all their previous performances in point of continuity and splendour.

Fig. 1 is a front elevation of the improved electric lamp movement; fig. 2 a view of it as seen from above, the screw wheel (B) being removed; fig. 3 is a vertical section.

The shaft A A, fig. 1, which this movement actuates, may either carry the electrode in a socket at its end, or it may merely act as a rod to push the electrode through a tube in a manner that is well known. This shaft consists of a screw, on which is screwed a crown tooth wheel B B, with the teeth downwards. The toothed or click wheel B B rests on a bit of upright circular tube *c c*, through which the shaft passes, and thus the shaft, being screwed into the centre of the click wheel B, is itself upheld. The upright fixed tube *d*, on the top of which the tube *c* fits, is furnished with a key fixed inwards, which fits into a slot *e*, which extends down the whole length of the screw shaft.

Hence when the wheel is turned round, the shaft cannot turn with it by reason of its slot and key, and therefore the shaft is caused to move up or down. Now a double click $f f^1$ works into the teeth of the wheel, the click being fixed in a central pin *g* in a horizontal sliding rod *h*, which is close beneath one side of the wheel, and slides endways through rectangular holes in the brass framework ΔΔ, and is provided at one end with a perpendicular slot-hole *i*, in which a small crank of a spindle (not shown) works, being made to revolve by means of a mechanical force such as common clockwork, whereby a reciprocating motion is given to the click rod *h*. Again; the click being heavier at one end, $f^1$, than at the other, *f*, the light end tilts up against the teeth of the wheel B, and as the click rod moves reciprocatingly, the click catches the teeth, and works the wheel round in one direction, whereby the shaft A is moved upwards, as before explained. Therefore, to reverse these motions, the other end of the click must be kept pressed gently in contact with the teeth of the wheel. This is effected by the top of the rod X pressing upwards from beneath against the heavy end of the click. This rod X is fixed vertically on the top of the iron centre V (see fig. 3) of a regulator coil R, such as we have before described as applied to regulate the self-acting rheostat.* The wire of the coil is included in the circuit of the electric current, which passes through the carbon electrodes to produce the light, so that when the current acts too powerfully it lifts the iron centre of the regulator, and thereby elevates the heavy end of the click, which, working on the wheel, makes the shaft and electrode to descend.

Now the force of the ascent of the iron, V, might (when the current is suddenly established) press the click too tight against the teeth of the wheel; to prevent this the top of the rod X is made hollow, and the lower part of the hollow is filled by a spiral spring *k*, upon which rests a small rod *l* (in the bore of the rod X), and pro-

* This we shall describe in a future Number.—Ed. M. M.

jects beyond the top of it. The small rod $l$ is kept pressed down upon the spring by a cross pin $m$ fixed through it, and passing through a short slot in each opposite side of the hollow rod X, so that the small rod $l$ can be pushed down for a short distance against the elasticity of the spring $k$. It is with this spring force that the regulator presses the heavy end of the click upwards. The small rod $l$ has a horizontal cross head, along which the end of the click can slide as it moves horizontally. The rod X is so long, that when the light end of the ratchet is jambed in a tooth of the wheel so that the other end hangs down, the rod X, in rising, touches the cross head of $l$, and so brings the immediate power of the regulator to bear on the click to disengage it; but the rod X is prevented (by a cross pin in the iron centre below the bottom of the coil) from rising so high as to follow the end of the click higher than its medium or horizontal position. The lighter force of the rod $l$ raised by the spring, is the force used to bring that end, $f^1$, of the click into actual contact with the teeth of the wheel.

Fig. 3.

But if the clockwork which works the click-rod be powerful, the rising of the shaft A will drive the electrodes together too forcibly; this is prevented by making the tube $c$, on which the wheel rests, to be supported, not rigidly, but by a spiral spring $n\,n$, which winds loosely around the fixed tube $d$, and the force of which can be regulated by elevating or lowering the ring $o$, to which the bottom of the spring is attached, by turning the nut $p$, on which it rests; so that when too great a pressure comes on the support $c$ by the electrodes being pressed together, the support $c$ sinks down, and lowers the wheel slightly, whereupon its teeth in moving round catch against a knob which projects upwards from the brass framework, and thus the wheel

is prevented from turning further in that direction, and the resistance thus opposed to the click stops the clockwork motion. The supporting tube *c*, under the wheel, is prevented from lifting the wheel too high above the click by reason of the framework $\Delta^1$, which fits over a collar or shoulder on *c*. This framework $\Delta^1\Delta^1$ is screwed firmly to the (square) top plate of the regulator coil, which is fixed in the framework of the lamp. By this improved movement a balance weight for the electrode shaft is not required, and the electrodes cannot be damaged by the surplus power of the clockwork. A small rod S (fig. 1) may project from the stem X of the iron centre, so as to stop the fly or balance of the clockwork power whenever the iron centre is in a medium position, but to release the fly whenever the iron centre rises or falls. The iron centre may have its weight partly counteracted by being suspended from one end of a lever, along which the other weights can be shifted so as to regulate the balance of weight on the iron centre as required.

## THE FACTORY "TEN HOURS" ACT.

Sir,—I am glad to see from your last Number, that you have taken up the subject (or at least allowed an intelligeut correspondent to do so) of the employment of women and children in Factories, and the excessive time of their employment. There is no one subject of more vital importance to the whole of the manufacturing population—and I cannot but think it a very appropriate one for the pages of a Journal which has so long been intimately connected with the interests of both "mechanics" and "manufacturers."

Your correspondent "B," has mentioned some of the most obvious and palpable of the mischievous consequences of this immoderate employment of women and children in Factories. Let any man, with a grain of common sense, just reflect for one moment on the effects of this unnatural system. Let him picture to himself, the father of a family coming home jaded and tired—and standing in need of all the comforts which "home" can afford—a clean house, wholesome food, and cheerful conversation. Instead of this, he finds his wife as tired and weary as himself, after her long day's work—no comfortable meal prepared for him, from the same cause—everything untidy and uncomfortable—children and all dull and dispirited, and utterly incapable of anything like cheerful intercourse. To revive his spirits he takes to drinking—and because his own house is not comfortable he goes to the public-house; and because his wife and children are too low-spirited themselves to entertain him, he goes to the ale-house or gin-shop not only for drink, but for amusement—for mental as well as physical stimulus. The whole process is as clear and decided, and almost as inevitable, as a proposition of Euclid—from the premises of over-work of the wife and children, to the conclusion in the destruction of the character and health of the father, the steps are unerring and certain.

These considerations alone ought to settle the matter,—even on bare pecuniary grounds they ought to settle it. For let the calculation be made: on the one side the extra gains by the wife and children—on the other, the money spent in drink, the loss incurred by the defective housekeeping, the doctor's bill caused by bad health; then see which is the greater total. The loss of happiness and real genuine household comfort, is beyond all calculation. The pure and constant enjoyments of a well-regulated family cannot be bought with the money that is gained, even though it were ten-thousand times greater.

But all this is too plain and obvious to require dwelling upon. There is one aspect, however, of the question, which has hitherto received little or no attention from the operatives themselves. To this I now more particularly wish to call their attention. I would ask them this simple question,—Have they reflected that, *by letting out their children in the way they do, they are taking the most direct and certain steps to lower their own wages?* They gain the full amount of their children's extra earnings, *only for a time.* How long that time may last, will depend entirely on circumstances: but nothing can be

more certain and inevitable, than the fact that, in the long run, this letting out of their children will end in reducing the wages of all the adult operatives. This is a point in political economy which has hitherto been too little attended to, and it is one which affects the interests and welfare of the working classes most deeply. When the manufacturer can obtain children to do his work as well as grown-up persons, and for less wages, the necessary consequence is, that either he will no longer employ adults at all, or else will only employ them at lower wages. If he adopts the first plan, and throws some of his adult labourers out of his employ, the competition between those thus thrown out, makes them all accept lower wages than before. So that it comes to the same thing in either way: in fact, the children become competitors against their fathers, and beat down their wages as effectually as if they were grown-up persons. This is no mere theoretical speculation, — it has been practically exemplified, only too often. I would recommend every one interested in this subject, and in the general welfare of the working classes, to read a narrative of the history of Paisley, and the degradation of its social condition owing to this cause, given in one of the Scotch papers some time ago, and quoted at length by Dr. Chalmers (Works, vol. xx., p. 172-7.) I will extract only one or two sentences:

"The increase of the family receipts arising from the employment of one or more children, as draw-boys, ceased on the first slackness in the demand; for it is evident that the additional sum, we shall suppose of *5s.* a week, drawn by the labour of the weaver's children, enabled him to work at just so much lower prices, to any manufacturer who might choose to speculate in making goods at the reduced price, in the hope of a future demand. A short period of idleness on the part of the weavers would have given time for the overstock of goods to clear off, whereas this practice of working even extra hours during the period of a glut, tended to perpetuate the glut, or to render fluctuations arising from this source more frequent, and, along with other causes, to perpetuate low wages. *Thus was the employment of their children from five to ten, by the weavers of Paisley, at first an apparent advantage, but in the end a curse; demonstrating that whatever may appear to be the interest of parents this year or next year, it is permanently the interest of them and their offspring, to refuse every advantage in their temporal concerns which tends to defraud youth of the first of parental blessings, education; and that Providence has bound, in indissoluble alliance, the intelligence, the virtue, and the temporal well-being of society.*"

Whatever the reader may think of the reasoning of this paragraph, we call his attention to *the fact*, that the Paisley weavers, who apparently gained so much by letting out their children, at first, soon lost all benefit even of a pecuniary kind, the wages of the parents being lessened, so as, perhaps, to make the sum total received by the family no greater than it was before the children were made to work.

Now, I am aware that many writers of authority on these subjects would raise objections to this view of the matter. They would say that the increased cheapness of the manufactured goods, thus caused by the greater employment of children, would cause so much greater a demand for the goods, that the manufacturer would be able to employ as much adult labour as before, and at as high wages. This is a favourite theory with very many writers on political economy; but like many other of their theories and statements, it is only true under certain limitations and conditions, which they have overlooked. It is, no doubt, true that in some branches of manufacture, and for certain periods, and within a certain range of prices, the increased cheapness of goods will cause so great a demand, that the manufacturer will still be enabled to employ as many people as before, and at as high wages. But this is only true in some cases and within certain limits. When a certain price is reached, and a certain annual amount of production, things become changed, and generally to the injury of our British operatives. In fact, it appears to me very doubtful whether we have not, for some time past, been working more for the benefit of the foreigner than for ourselves; that both our capitalists and operatives are straining every nerve, and working day

and night, without any adequate return for their labour and capital. I strongly suspect that good John Bull has made himself a universal drudge, and that for much less labour he would be as well paid by his foreign acquaintance, if he were not so eager in cheapening his own goods. Everybody is working harder and harder every year, and none apparently the better for it, in this country, except some few who have the means of making the rest work for them. But enough for the present. I shall be satisfied if these hints suffice to make the reader think for himself. I may just observe, however, in conclusion, that the remarks quoted from the *Morning Chronicle* by your correspondent, are liable to the objections I have made against the prevalent theory of political economists, on the effect of increased cheapness in manufactures. It is only to a certain extent that their theory is true—it is only up to a certain limit that capitalists will receive *greater profits for increased production*. In the case supposed, I very much doubt whether there are any branches of manufacture in which the writer's notions could be realized as to the doubling of profits by doubling the hours of work. There is only a market for a certain amount of our goods, and to produce more is only to cheapen our own produce unnecessarily, and to lower the profits of our capitalists, instead of increasing them.

I am, Sir, yours, &c.,

A. H.

## MATHEMATICAL PERIODICALS.

(Continued from page 65.)

### XX. *The Miscellanea Scientifica Curiosa.*

*Origin.*—This periodical appears to have been set on foot towards the close of the year 1766, the first contribution bearing the date "York, July 3." From an introductory letter by J. Randall the design of the work was to promote the interests of science generally, but more particularly to assist "Young Gentlemen in *Natural Philosophy*, the *Mathematics*, or *Commerce*:" the good intentions of the conductors, however, were soon frustrated, for like most works of this class its career was but of short duration, and it terminated its existence with the *eighth* number towards the close of the year 1769. The copy from which I quote has the following title-page in M.S., "Miscellanea Scientifica Curiosa, London, 1766;" the work is also referred to by Lawson, in his "Synopsis of Data," as published during 1766-9, and a manuscript note by Mr. Samuel Maynard states, that "this volume is complete and contains all published; there never was a title printed to the work."

*Editors.*—That more than one was engaged in the management of this periodical is evident from various communications, but who these gentlemen were, neither *internal* nor *external* evidence has enabled me to offer a conjecture worthy of notice.

*Contents.*—The usual contents of each number are, Essays and Dissertations on various Astronomical, Mathematical, Agricultural and Botanical subjects; Answers to Mathematical questions; new questions for solution; Answers to "the Grammatical, Philosophical, Theological" and other questions, together with new enquiries respecting various points in "Grammar, Rhetoric, Logic, History, Philosophy, Theology, &c." Many of these bear evidence of having been compiled with much care and considerable labour; and when it is stated that several of the correspondents to this department were clergymen of high reputation, some idea may be formed of the sterling worth of the major portion of these communications. Art. XIII. contains "An Essay upon the *Origin*, *Nature*, and *immediate Derivation* of the *Soul* of *Man*; in answer to the *first* Theological Question." The answer to Ques. 17 furnishes "a more short and intelligible method of discovering the Genders of Latin Nouns, than by Mr. Lilly's *Propria quæ Maribus*;" that to Ques. 37 furnishes "A Compendious rational Syntax of the Latin Language." Ques. 39 defines the meaning of the word "Term" in Logic; and Ques. 43 contains a dissertation on the "Origin of Springs."

The Rev. Mr. Green, of Denmark-street, London, in answer to Ques. 44, suggests "what means, under God, would be the most probable prevention of dearness of corn and scarceness of bread in these nations." The Rev.

gentleman's means may thus be briefly stated.

I. "Let Royal storehouses, or public granaries be erected in every corn-market, and when corn is at a low rate, let them be filled therewith: but as it begins to be dear, let them begin to empty, at a moderate price."

II. "Let all our nobility and gentry, who are true and disinterested patriots, renounce, abjure, and abhor, that unpopular, oppressive, and monopolizing scheme, of throwing various farms into one."

III. "Let forests, and other useless, not to say expensive, crown lands, capable of cultivation, be enclosed . . . . . . disposed of . . . . . . and planted with villages."

IV. "Let the nobility and lords of Manors, imitate the Royal example, with respect to commons and other waste grounds."

V. "Let rice or any other succedaneum, in a time of scarcity be imported duty free, and let no corn be exported, but when the public granaries are properly filled, and corn under four shillings the Winchester bushel."

VI. "Let the lieutenants of every county be deputed to assign premiums for the greatest improvements in agriculture. Let his Majesty also assign a Royal premium, or premiums, for the best of these."

VII. "Lastly, since *righteousness exalteth a nation, and sin is the reproach of any people*, let all orders of men among us, 'put away the evil of their doings.'"

The last means is perhaps the best, and though Mr. Green would seem to have been somewhat in advance of the age in these matters, yet as political discussions do not fall within my province, I shall leave his claims as a political reformer to be settled by Messrs. D'Israeli, Cobden, and the redoubtable Feargus O'Connor.

In the answer to Ques. 49, the Rev. Mr. Green furnishes several learned reasons for considering, "that the *Hebrew* is the most ancient language;" that to Ques. 53, gives "the Accidents of the Eight Parts of Latin Speech;" Ques. 54 points out the logical difference "between *real*, *mental*, and *modal* distinction;" and in the reply to Ques. 45 (which is one of those misplaced in the work), the Rev. Mr. Spencer, of Bradford, in Wiltshire, supplies an able commentary on the meaning of the word "*creature*," in the eighth chapter of St. Paul's Epistle to the Romans.

The Poetical department is very limited, and contains little worthy of notice. The *spirit* of some of the effusions is by no means commendable, since it savours too much of intolerance, at least for the *present* day; several of the enigmas, however, are not devoid of merit, and here and there may be found a happy translation of a Greek or Latin epigram, for which small prizes were occasionally given. The Mathematical and Philosophical departments of the work contains many valuable papers by some of the most distinguished writers of that time; amongst whom may be noticed Messrs. Hutton, Green, Todd, Allen, Wales, M'Carthy, Drape, Dalby and Vince. Perhaps the following enumeration will not be unacceptable.

Art. I. An Essay on the Advantages arising from Foreign Trade. By J. Randall, of York.

Art. II. A New Method of Computing Solar Eclipses. By Felix M'Carthy, of Aberdeen.

Art. III. The demonstration of a very useful Lemma, concerned in the investigation of the height of the Tides, and Precession of the Terrestrial Equinoxes. By Thomas Allen of Spalding.

Art. IV. A Dissertation on the nature of Curves, formed by a heavy flexible line hanging freely from two points of suspension, P and Q. By Charles Hutton, of Newcastle.

Art. V. The investigation of some Theorems for finding the solid contents of the Frustums of Cones, Pyramids, &c. By J. Drape, of Whitehaven.

Art. VI. Some Observations from Experience, on the Nature and Effect of *Dove Manure*, or of manuring the Clay Grounds in Lincolnshire with Pigeons' Dung. By William Swift, of Stow.

Art. VII. Historical Account of the proceedings relative to the Discovery of the Longitude. By C. Green.

Art. VIII. On the Constellation Aries. By the Editors.

*** This was the first of a series of Articles on the Constellations, illustrated by folding plates, beautifully engraved on copper, by "J. Lodge, Sculp.," they were ultimately intended to form a

"*New Celestial Atlas*," and on this account were accompanied by historical descriptions and catalogues of the Stars in each Constellation. The discontinuance of the work put an end to the project after the illustration of Aries, Taurus, Gemini, and Cancer.

Art. VIII. *bis*. Observations and Experiments on the Culture of Lucern. By Middletoniensis.

Art. IX. On the nature of *Double Flowers*, and the Methods of producing them. By James Meader, author of the Botanical part of the *General Dictionary of Arts and Sciences*.

Art. X. A true Definition of Compound Interest. By Philalethes, Westsmithfieldiensis (Thomas Todd).

*** This article was written by Mr. Todd, in order to point out the erroneous views of Mr. Robert Heath, "the Palladium Author," as stated by him in the *Palladium* for 1766, and also in the "*Public Ledgers*" for 1765, where it appears the "gallant Captain" had "contradicted all the Authors who have wrote on the subject, and also what *Sir Isaac Newton* himself approved of September 10, 1685, in a book called "*Tables for Renewing and Purchasing of Leases*, &c.," and all this, without any better proof than his bare "*ipse dixit*."

Art. XI. The Investigation of two Propositions relative to the Motion of two given Bodies, connected by a String, and moving by the force of Gravity over a Pulley. By Thomas Allen.

Art. XII. A Supplement to Art. VI. By William Swift.

Art. XII. *bis*. On the Constellation Taurus. By the Editors.

Art. XIII. On the Soul of Man. By Chlorus.

Art. XIV. Catalogue of Stars in the Constellation Aries. By the Editors.

Art. XV. A reply to Mr. Swift's Structures. By Middletoniensis.

Art. XVI. An Essay on the Nature, Choice, and Method of raising Mushrooms. By John Giles, of Lewisham.

Art. XVII. The Investigation of a Theorem in Mensuration. By J. Drape.

Art. XVIII. Catalogue of Stars in the Constellation Taurus. By the Editors.

Art. XIX. A Plain and Familiar Dialogue upon the Nature, Use, and Excellency of the Art of Book-keeping, after the Italian Method. By Londinensis.

Art. XX. The Theory of the Fixed Stars. By William Wales.

Art. XXI. Catalogue of Stars in the Constellation Gemini. By the Editors.

Art. XXII. Catalogue of Stars in the Constellation Cancer. By the Editors.

Art. XXIII. On the Production of Fungi, in opposition to Mr. Giles's Theory of their being "produced from excrements of various kinds." By Stephen Hartley, of Halifax.

Art. XXIV. A Catalogue of the more rare Plants, growing in the Vicarage of Halifax; arranged according to the System of Linnæus, with their Synonimes from his *Species Plantarum*, together with their English names, the particular places where they grow in the said Vicarage, and also the time when they are found in flower. By Stephen Hartley.

*Questions*.—The total number of Mathematical questions proposed in this periodical was 73, of which only 57 received answers. Geometry and the Applications of the Fluxional Calculus appear to preponderate; 15 questions properly belong to the former subject, and 13 to the latter. Of the rest, four belong to Algebra; eight to its applications to Geometry, Mensuration, &c.; seven to Trigonometry; six to Mechanics; three to Astronomy; and one to the Doctrine of Chances.

Ques. 9 is proposed by McCarthy, and requires "between two right lines AB, AC, given by position, to draw a right line DE, which, terminating in the two former, shall cut off a triangle ADE, similar to a triangle given, and likewise be equal to a line joining the extremity E of the required line, and some given point P': a problem to which a neat solution is given by Mr. W. Chartreux.

Ques. 11 is proposed and answered by Mr. Thomas Allen, and supplies a proof to Art. 291, *Simpson's Fluxions*, or *Cor. page* 123 of his *Dissertations*.

Ques. 17, by Mr. Robert Hall, requires the "Diameter of the greatest Semicircle that can be inscribed in a given Quadrant;" an elegant solution to which is given by Mr. Samuel Ogle, of Rotherhithe.

Ques. 20 relates to the subject of Art. XI., and appears to have given rise to that paper. It was reproposed "by the *Palladium Champion* of London," in order to correct an erroneous solution given to it by the *learned judge Fluxion*,

in the *Palladium* for 1751. Good solutions were furnished for the *Curiosa* by Messrs. Allen and Todd.

Ques. 22, proposed by Mr. McCarthy, "gives an ellipse in magnitude and position, and requires to draw a tangent thereto, which shall likewise be a tangent to a given circle, the distance of whose centre from that of the ellipse is also given." Elaborate solutions are given by Messrs. Gawith and Hutton; the proposer also observes, "that it ought to have been remarked that this curious and very difficult question is not his own, but was given him by *a gentleman well known in the mathematical world*, with permission to publish it." Who could this be?

Ques. 26 requires "the Odds against the Dealer and his Partner, holding three honours precisely at the game of Whist." An incorrect solution was given to this question by Mr. Baker, which was afterwards corrected by Mr. Blunt, of Crowland.

Ques. 28 is a neat indeterminate theorem, which states that, "If P$Ap$ be a triangle, right angled at A, AC perpendicular to P$p$, AEBD a circle whose centre is C, and radius CA; and if KL bisect P$p$ at right angles; I say, that a circle PDEI, whose centre is any point H, in the indefinite line KL, described through one of the points P or $p$, shall likewise pass through the other and intersect the periphery of the former circle in opposite points D, E." It was proposed "by Mr. H. Steele, teacher of the mathematics, in London," and is elegantly solved by an anonymous correspondent, who adopts the signature of "Pappus, junior."

Ques. 30 relates to the content of the solid generated by the revolution of a certain curve:—it was re-proposed for correction from *Martin's Magazine*, and is noticed here on account of a difficulty in its solution having led to a curious and somewhat amusing controversy between Messrs. Todd, Hutton, (under the signature "Tonthu,") and Blunt, which may be seen in pp. 108, 165, 189. The last-named gentleman was the first to see through the difficulty, but by the time his "Animadversions on M. S. C.," made their appearance, Messrs. Tonthu and Todd had arrived at the same conclusions, and hence the Editors observe, "that these two fierce combatants seem now perfectly reconciled."

Ques. 31 is proposed and answered by Mr. Charles Hutton, who "investigates a general rule for finding the area cut off from a given ellipse by a right line inclined to the axes in any given angle." Several of the questions treated of by Mr. Hutton in this work were afterwards incorporated with his "*Treatise of Mensuration*," which in p. 237 is announced as "just ready for the press." The *first* edition of this work was published in 1770, which proves that the *last* number of the *Miscellanea* was published previously to this date.

Ques. 43, by Mr. Allen, removes an obscurity from Art. 289 of *Simpson's Fluxions*, and naturally arises from the consideration of Ques. 11.

Ques. 47 belongs to the subject of *envelopes*, and supposes "two equal right lines, NB, BM, perpendicular to each other, to be divided into any number of equal parts, NA, A$a$, $ab$, &c.; B$o$, $om$, $mn$, &c; and the lines NB, A$o$, $am$, &c., drawn; they will be tangents to the common parabola whose equation is $(x+y)^2=4\ by$; where $b$=NB, or BM, $x$ the abscissa beginning at N or M, and $y$ its corresponding ordinate." It was proposed and solved algebraically by Mr. Todd.

Ques. 50 was proposed by Mr. McCarthy. It assumes a point in the circumference of a given circle, and requires "to find, *geometrically*, another point in a right line passing through the assumed point and the centre of the circle, from which, if a tangent be drawn, and a right line drawn from the assumed point to the point of contact, this last shall obtain a given ratio to the line joining the assumed point, and that which is required." An elegant solution is given by Mr. H. Steele, and "the proposer, after constructing the question in a different, but not less elegant manner, adds, 'By means of this proposition, a great number of the most difficult problems in geometry may be readily constructed.'" The Editors observe, that "none else of our correspondents attempted a construction to this very difficult question;" however, in the succeeding Number a construction and demonstration were given by "Pappus, junior," the "extreme elegance whereof (was) deemed a sufficient excuse for giving them a place." Mr. Steele also in the same place furnished a sequel to his former construction.

Ques. 55 demonstrates, that "if through the centre of gravity G of a triangle ABC, a right line IG, PQ, be drawn, meeting any side BC, produced in Q; then AC.BQ−BC.CP=3CP.CQ." It was neatly answered by the proposer, Mr. Edward Nott, of Stamford.

Several of the questions left unsolved on the discontinuance of the work possess considerable interest, especially the following indeterminate theorem proposed by Mr. S. C.:

"C is the centre of a given circle, and P a point in that circle; join the points P, C, and produce PC indefinitely; draw NCL at right angles to PC, and finding the centre H of a circle that will pass through the points N, P, L, erect the indefinite perpendicular HS; in this perpendicular assume any point I, and from thence as centre with IP as radius, describe an arc of a circle MPK, and it will cut the circle NMLK in opposite points."

This proposition does not appear to have been re-proposed in any succeeding work of this nature, but most of the remaining ones were subsequently transferred to the pages of the *British Oracle*, which rose, phœnix-like, from the ashes of the *Miscellanea*. A short account of the *Oracle* has already been given in pp. 561-5, vol. l., of this Magazine.

*Contributors.*—Allen, Antrobas, Barker, Berwick, Blunt, Bolton, Chartreux, Chlorus, Christianus, Cole, Dalby, Drape, Eboracensis, Gawith, Giles, Green, Hartley, Hutton, Lyons, Londinensis, Mayo, McCarthy, Meader, Nott, Ogle, Pappus, jun., Philalethes, Priestley, Rahonan, Randall, Sadler, Spencer, Swift, Steele, Swintonensis, Todd, Vince, Viretus, Wales, &c., &c.

*Publication.*—As to the mode of publication "deponent witnesseth not," but since the eight numbers were completed within the years 1766-9 inclusive, it is most probable that three numbers were issued annually. From a prize offered for the solution of Ques. 12, p. 25, it is probable that "Richardson and Urquhart" were the publishers of some of the earlier numbers, and similar references in pp. 153, 182, point out "Newbery" as the publisher of the remaining portion of the work.

THOMAS WILKINSON.

Burnley, Lancashire, March 27, 1850.

## DESCRIPTION OF AN APPARATUS FOR APPLYING FURNACE GASES TO HEATING PURPOSES.

(From the *Mining Journal.*)

We are this week enabled to lay before our readers engravings of the mode adopted by the Ebbw Vale Company, at their Ebbw Vale, Victoria, and Sirhowy Iron-works, in South Wales, for collecting and using the gases from blast furnaces. At these works there are 11 furnaces in blast, making from 1400 to 1500 tons of pig-iron per week; the five blast-engines have 25 boilers attached to them. At present 19 of these boilers, with the gases applied to them, get sufficient steam to work the engines to their maximum duty *without using coal.* The pumping-engine at Sirhowy-works is worked also by the use of the furnace gases. Last week the gases were applied to several hot-air stoves, and they are now preparing to apply the same to the calcination of iron stones, moulders' stoves, and other purposes.

The present depressed state of the iron trade, and the loss sustained in carrying it on, requires the most rigid economy; and we are pleased to be able to give publicity to the energy and enterprise the Ebbw Vale Company have displayed in bringing into extensive *practical* operation these most important savings.

The Ebbw Vale Company already save 1000 tons of coal per week by these means. We are also informed Messrs. Darby are using these gases at their works in North Wales most successfully.

### *Description.*

Fig. 1 represents a section of a blast-furnace, of the usual description, within the top of which is introduced and fixed a cylinder or tube, C, by which an annular chamber, EE, is formed round the inside of the furnace to receive the gases. This tube is made of common boiler-plate, three-eighths or half an inch thick, with 3 inch angle-iron riveted round the top, forming an outside flange, which rests upon the cast-iron ring usually placed on the top of the furnace immediately under the charging plate. The diameter of this tube should be about 12 inches less in diameter than the inside of the furnace at the top, and the depth of the same 6 to 7 feet. A little fine dust thrown round the angle-iron after the tube is lowered to its place makes a perfect joint; and thus far all is complete. A orifice is made through the brickwork of the furnace, in which is inserted the pipe, F, for conveying the gas from the annular chamber to the place of combustion.

Fig. 2 is a section of a tubular boiler; AF is the pipe, and G is a box resting on

Fig. 1.

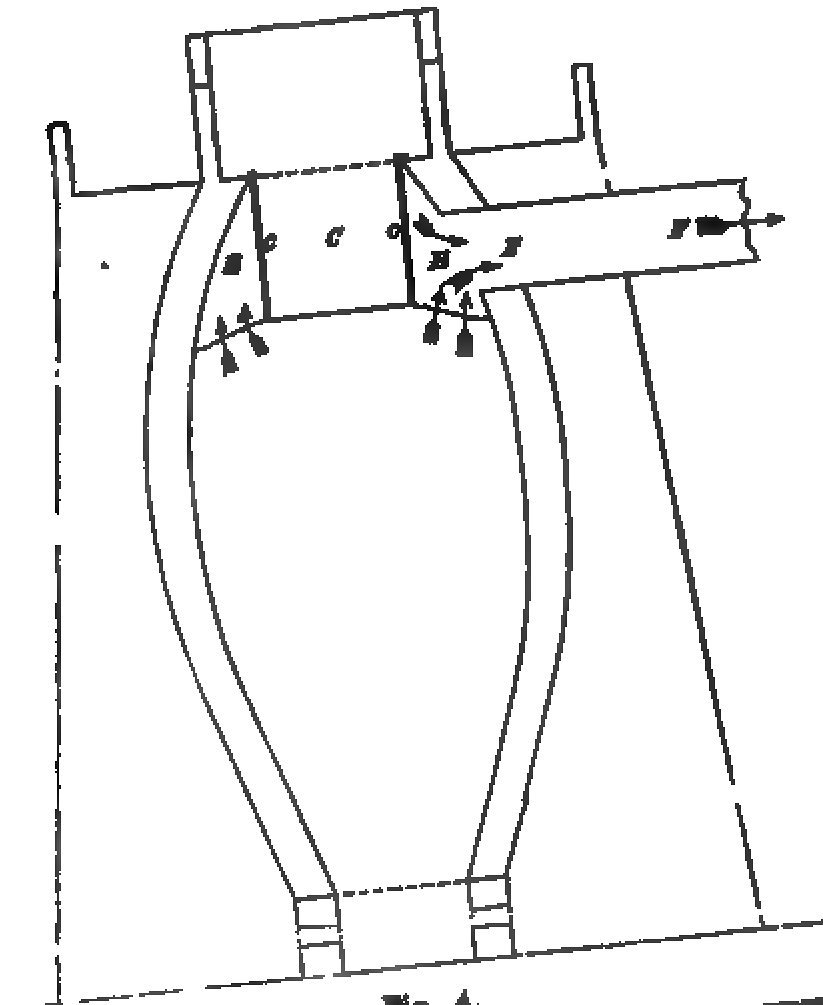



Fig. 4.

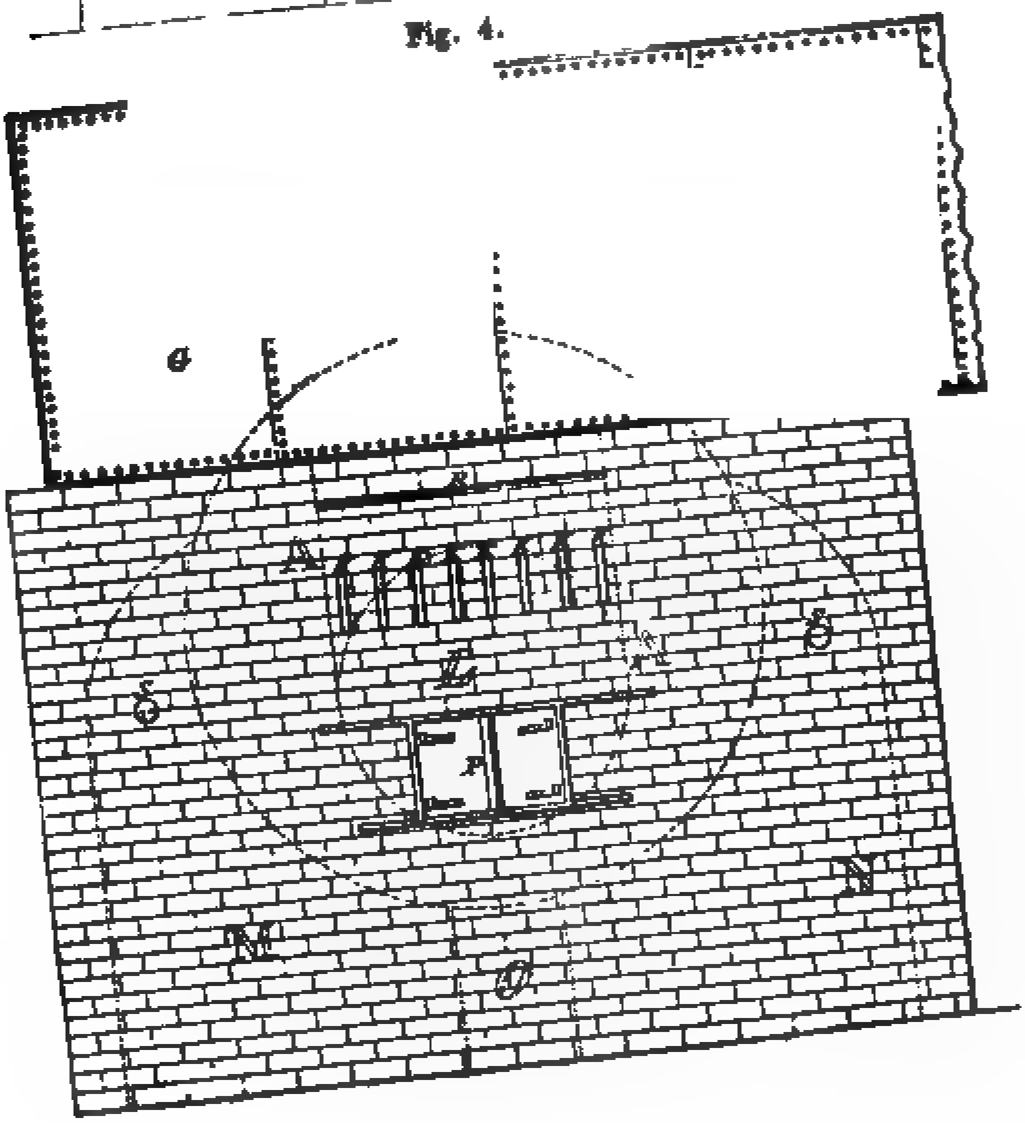


Fig. 2.

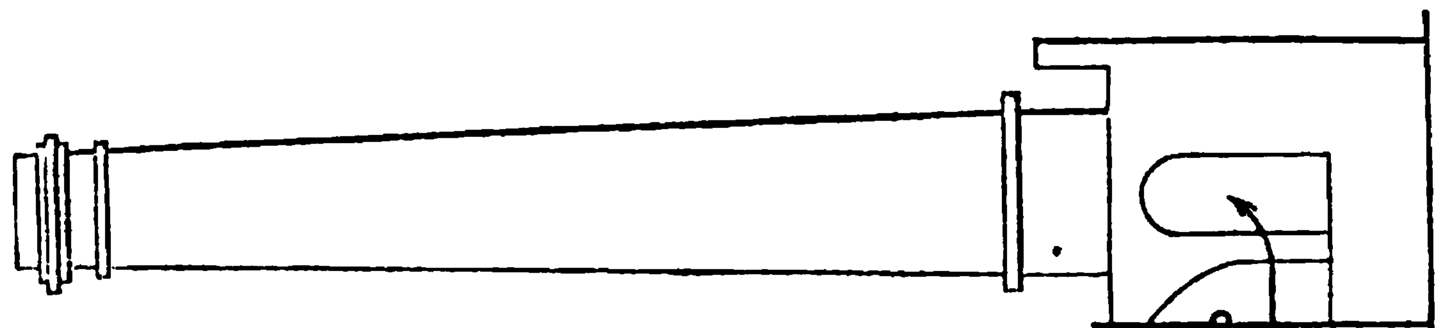
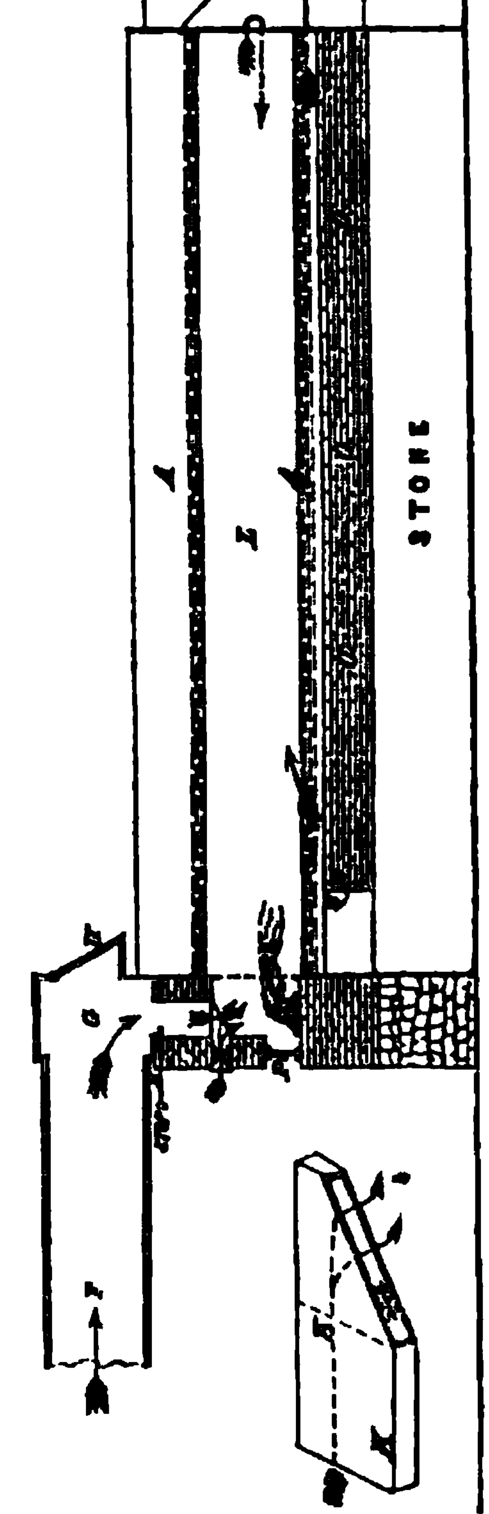
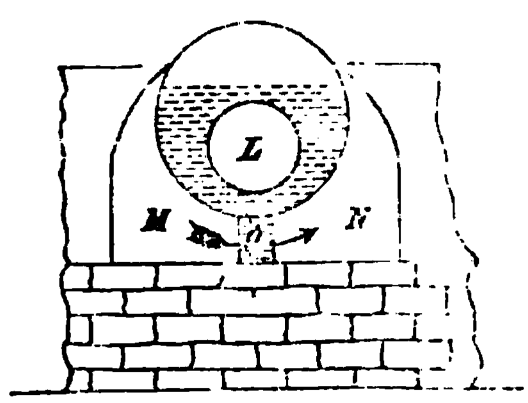




Fig. 3.




the brickwork, and into which the gases are brought previous to entering the tube of the boiler. H is a slanting door, for the purpose of cleaning the tubes, as well as safety in case of explosion, when it is forced open (thereby preventing injury to the flues, &c.), and falls to its place by its own gravity; K is a box or burner, made of thin sheet-iron, and bevelled off at one corner, as in the drawing; the opening being 9 in., by three-fourths of an inch, for the purpose of admitting atmospheric air in thin sheets to consume the gases, the top of which is placed level with the top of the tube. The gases pass from the box, G, to the entrance of the boiler-tube, L, where the air is admitted through the burners, KK, and the whole ignited by means of a little fire placed at the entrance, and inside the door, P (care should be taken by preparing this fire some short time before bringing the gases down, and it will be well to keep a very small quantity of fuel always burning, more particularly when the gases from one furnace only are used). Combustion then takes place in and through the tube, L, the side-flue, M (see fig. 3), and back along the flue, N, to the stack. The brickwork, O, supports the boiler, but is not continued to the end, in order to form a communication between the side flues, M and N.

Fig. 3 is an end section of boiler and flues.

Fig. 4 shows the front elevation of the brickwork, sheet-iron box, G, the door, P, the stop, R, for shutting off the gases when the boiler requires cleaning, &c., and the mode of placing the burners, KK, so that the air and gases may mix as much as possible previous to ignition. SS are holes left in the brickwork opposite the side-flues, to enable the combustion of the gas to be seen.

## MARSDEN'S PATENT ROTARY TRAP.—(SEE ANTE, P. 238.)

Fig. 2. Fig. 1. Fig. 3.

Fig. 1 is a vertical section of a trap for a street sewer, constructed according to this invention; fig. 2 a back elevation of the same; and fig. 3 an under view of the apparatus, with part (E) removed. A A is the external grating; B B the brickwork of the gully leading to the sewer; C a hood, of the peculiar form represented; D a broad rim or flange, by which the hood rests upon and is suspended from the brickwork, this flange being made air tight all round by cement. E is a drum or wheel, which turns upon two pivots F F within the under half of the hood C; H H are two partition plates, by which the drum is divided into four equal compartments, having no communication interiorly with each other, forming thus, in effect, four separate receivers or buckets. I, I, I, I, flaps of vulcanized Indian-rubber, or any other suitable flexible substance, which overhang the four compartments of the drum, these flaps being secured by rivets or screws at their upper ends to ledges *b b*, projecting from the inner surface of the lower half of the hood, but left loose at their lower ends; and K K (see fig. 3) are two more flaps of vulcanized Indian-rubber, which press sideways upon the flaps I, I, I, I, and close up the ends of the drum.

The street drainage, falling through the grating, passes first into the upper half of the hood, from which it descends into one of the compartments or buckets (whichever happens to be uppermost at the time), and as soon as that bucket becomes filled, it tilts over of its own weight, and empties itself into the drain M, while another bucket ascends from the opposite side to take its place. One of the buckets is thus always being filled, a second in the course of emptying itself, and the two others on their ascent to be filled and emptied in their turn, while any upward escape of effluvia during these successive changes is effectually prevented by the overhanging flaps I, I, I, I, and end flaps K K.

## ELECTRIC COPYING TELEGRAPH.

Sir,—The communication of Mr. Bakewell, in your last Number, (page 223) calls for a few remarks; the following brief notice may perhaps suffice:

I can very easily understand that the "opinion" I have expressed upon the question at issue between Mr. Bakewell and Mr. Bain may be somewhat unpalatable to the former gentleman; nevertheless, I deny that it is either "wrong" or "coarsely expressed;" neither am I blinded by "partizan" zeal.

Mr. Bakewell compels me to say, that I never, for one moment, believed his assertion that he had made any disclosure to Mr. Bain; we now have Mr. Bain's positive denial that he ever did so!

Mr. Bakewell says, "Let Mr. Baddeley mention the date when he saw Mr. Bain operating with a copying telegraph in all respects identical with that described in No. 1383 of your Magazine."

I have already stated, and can prove the truth of my statement, that this was *previous to the date of Mr. Bakewell's patent.*

Whether it was one year, or three

years, is not of much consequence; the fact itself, as stated, completely disproves the assertion of Mr. Bakewell, that "this was not *till after* Mr. Bakewell's patent was sealed and specified!"

Mr. Bakewell is "curious to know whether Mr. Baddeley exhibited Mr. Bain's copying telegraph in Paris, in July last?" Now I have no hesitation in informing him that I did not exhibit that instrument; but let me add, that the instrument had long been completed, and was *patented* in France *before that time*, and that the engravings in your 1383rd Number were actually made from the tracings of the French patent!

Mr. Bain, it appears, is at present on the continent; on his return, I have no doubt he will satisfactorily dispose of Mr. Bakewell's last attempt to throw dust in the eyes of your readers.

Upon the first announcement of Mr. Bakewell's copying telegraph, it was put forth as a new idea—as a perfectly original invention. It now, upon Mr. Bakewell's own showing, sinks into an alleged *improvement* upon the copying telegraph of Mr. Bain, as patented in 1843, of which patent Mr. Bakewell's alleged improvements may or may not be an infringement; but it looks extremely suspicious, that while Mr. Bakewell most pertinaciously adheres to the subject-matter of that patent, he so carefully avoids the slightest allusion to *what he saw Mr. Bain doing* in 1847, at the time he is represented to have been such a constant visitor at Mr. Bain's workshops, and where he is said to have been shown the *precise modification of Mr. Bain's copying telegraph*, which he afterwards patented!

I am Sir, yours, &c.,

Wm. Baddeley.

29, Alfred-street, Islington,
March 27, 1850.

## PREVENTION OF GUNPOWDER EXPLOSIONS.

The recent deplorable calamity at Hounslow has called to mind some of Sir Samuel Bentham's projects for diminishing the chances of such explosions; although his plans were never matured, they may possibly be worth communication, for they may lead to the contrivance of means for obviating the dangers to which powder-mills are now so liable.

General Congreve drew Sir Samuel's attention to the subject about fifty-five year's ago, and said that the heat produced by friction of machinery, especially in the grinding apparatus, was one chief source of danger in powder-mills. To guard against that heat Sir Samuel devised means of surrounding machinery by a stream of water, or at least by its partial application to keep the apparatus always cool; of course so encasing the water as to prevent its injurious effects either on the machinery or the materials of the powder. Supposing sufficient means provided for carrying off heat, he conceived that the different mixing, grinding, and corning apparatuses would be safer if of metal than of stone, particularly the bed-stones of the mills, as under these beds water might be made to flow with much facility. Subsequently he caused a mixture of metals to be made in Portsmouth dock-yard, which might prove well suited for this purpose; it was so hard that 10-inch bolt nails of it could be driven into oak without previous boring for them, and tough enough to prevent breakage in driving. Abrasion of this metal in grinding would not therefore have to be apprehended.

An improved drying-house was another of his projects. He first suggested steam, confined in suitable hollow cases, as shelves on which to spread the powder; steam has since been adopted in drying-houses; but an after thought was that of the circulation of hot water through the hollows of the shelves Hot water is more easily manageable than steam, and the required degree of heat more easily regulated, as is now experienced in the many glass plant-houses heated by water from one small boiler. The boiler, whether for steam or water, he purposed placing in a detached building, so as to avoid all danger from the furnace fire.

The roofs of all buildings to be of a very great pitch, so that no substance thrown against them should find lodgment for a moment: the material for the exterior of the roof cement of an uninflammable nature,—iron, on account of danger from lightning, being objectionable. The cement to be spread in one continuous, uniform surface, so that not even a spark blown against it should find a hollow to rest in.

All apertures for light glazed with

illuminators of thick glass, such as were inserted in cabins under water in his experimental vessels, and which are now in such general use, but of much larger size, in domestic architecture.

In some foreign powder-mills the apparel of the men is not only regulated in respect to shoes, but also to the whole exterior of their dress, so that no mischievous matter can be carried in its folds. The dress is tight fitting, of a flexible kind of leather. The late grievous accident at Hounslow is supposed by some to have been occasioned by grit carried in by a man's trousers. Other persons conceive that his shoes might not have been changed for slippers, as required by regulations. How difficult it is to enforce the most wholesome regulations, or to make operatives prudent! General Twiss once found even an overseer at Waltham Abbey mills examining the grains of powder with a convex glass in the sun. The General invited the overseer to the open court, where, on continuing the examination, the magnifier concentrated, of course, the sun's rays, and the powder exploded. Whatever regulations may be thought necessary, or whatever precautions requisite to be instilled into the men, might it not be desirable that they should be read over to them at stated short intervals of time, in addition to notices placed in conspicuous parts of the mills?

M. S. B.

### THE CHEMICAL ACTION OF REMEDIES.

Sir,—In the "Remarks on Experimental Science," prefixed to an account of the researches conducted in the laboratories of the Royal College of Chemistry in the years 1845-6-7, the highly talented Professor Hofmann alludes to "the benefits which physiology, pathology, and medicine in general must derive from the prosecution of chemical inquiry." He says, "The view that the action of most of our medicines is chemical, is daily growing into a general conviction. We admit, that with every change wrought by pharmaceutical agents in the state of our organism, there occurs a corresponding change in its composition. But of these transformations how few are we in a condition to explain; in how few instances has the physician even a vague conception of the mode in which any medicine performs its office." Dr. Hofmann further remarks, that these transformations, produced in our organism by remedies, "could doubtless be expressed in numbers as definitely as can our laboratory processes;" and seems to be of opinion, that such knowledge of the *modus operandi* of medicines "may be expected from the further prosecution of this study."

It appears to me that no physical subject of inquiry is more worthy of the efforts of the mind of man than this;—because not only is health the greatest boon that one creature can procure for another, but the alleviation of suffering is the noblest object to which life can be devoted. Allow me to contribute my mite, by suggesting an idea in your widely-circulated pages: I may, perhaps, add one more to the "few instances in which the physician has a vague conception of the mode in which a medicine performs its office."

In cases of fever, the doctor allows no *butter*, and the good nurse anxiously removes every particle of *fat* from the broth of the recovering patient. *Observation* has taught this. But what light may be thrown on the subject by bringing to it the researches of the illustrious Liebig! He has shown that such substances are not truly *nutritious*, and hence we may perceive the vulgar error of supposing that it is their *nourishing* nature that *feeds* the disease. But he has further shown such substances undergo slow combustion in the lungs, and are the source of animal heat. This suggests, I presume, a reasonable explanation of their tendency to increase fever, in which the preternatural temperature of the body is either the disease itself, or a condition essential to the development of it. I allude to *inflammatory* fever; and it just occurs to me that my views are illustrated by the fact, that certain carbonaceous substances are not only *allowed*, but *recommended* by the physician in typhus, and other low fevers in which the temperature of the body is little raised. Hence it appears that they are objected to *only when the heat which they evolve would be injurious*. Thus we have an *à priori* conclusion on the part of physicians and nurses in favour of the *chemical explanation* suggested.

But this is not all. The foregoing

theory of the chemical action of the substances *forbidden*, is corroborated by the chemical nature of the substances *prescribed*. As the chemical composition of these latter substances affords a sufficient explanation of their remedial effect, we have, it appears to me, a very striking indication that the laws of chemical affinity which we have discovered will not forsake us when, with the progress of science, we come to attempt the physical resolution of vital phenomena.

The common "*refrigerant* draught for fevers," (observe the word,) contains a scruple of subcarbonate of potash, and this is taken into the system, with great effect, *every three hours*. Thus empiricism cools the feverish patient by throwing into the system a considerable quantity of alkali. Now, alkalis combine with oleaginous matters, saponify them, and thus render them unfit for combustion. Observation has taught the physician not only to forbid the supply of fuel to be consumed, but also to introduce into the system that which renders the inflammable substances already there less combustible,—that which, in fact, combining with them by a powerful affinity, protects them from the process of oxidation in the lungs, which is the source of the heat it is his object to subdue.

Finding that my former communication interested some of your chemical readers, I again venture to claim their indulgence, and am, Sir,

Your Old Subscriber,

M. F.

## ON THE CAUSES OF THE EXPLOSION OF STEAM BOILERS AND OF SOME NEWLY-DISCOVERED PROPERTIES OF HEAT. BY MR. JAMES FROST, OF BROOKLYN, NEW YORK.

(Continued from page 257.)

When a pound of hydrogen is burned in a calorimeter, it, combined with eight pounds of oxygen, forms nine pounds of water, and gives out as much heat as will melt 320 lbs. of ice, [Dalton,] hence one pound of those cold atomic elements, in a gaseous state, contain as much of the elements of heat as will melt 35.55 pounds of ice.

When one pound of steam of any temperature above 212° is condensed within a calorimeter, it forms a pound of water and gives out as much heat as will melt 8.35 lbs. of ice; so that 4.25 times as much of the elements of heat were separated from the pound of water derived from the cold gases, as was separated from the pound of water derived from the hot steam. Nevertheless the volume of steam and of the gases under atmospheric pressure is about three to two in equal weights of each, (so that the gases are much less expanded by heat, though they contain such a larger proportion of it.) An addition of 480 degrees of heat to the gases would only double their volume, while the same addition of heat to steam would increase its volume more than tenfold; the small abstraction of 180 degress of heat from steam, would reduce its volume to $\frac{1}{1700}$, while the abstraction of an equal number of degrees of heat from gases would reduce their volume little less than two-thirds, while the pounds of ice melted, by the heat obtained from equal volumes of equal tension of thirty inches of mercury, will be as follows:—

| | | |
|---|---|---|
| Oxygen and hydrogen gases, at | 50 degrees, | 25.33 lbs. |
| Steam . . . . | 212 " | 8.35 " |
| Stame . . . . | 650 " | 1. " |

The elements of heat in the gases are evidently in some peculiar and definite state incompatible with any known theory of heat. This state cannot be termed "latent heat," because the gases are permanently maintained in an elastic, though very subordinate state (because the same equivalent of heat contained therein would suffice for producing more than four volmes of steam of equal tension). It is not heat, because the gases may be exposed to the most intense cold, without being reduced from a great volume of elastic fluid to an inconsiderable volume of water or ice. The elements of water too therein, are as evidently in some peculiar state of combination with elements of heat, unexplainable by any known theory of heat, being irreducible to the wet, liquid, or solid states, by any degree of cold.

From the foregoing and subsequent considerations may be deduced the inference, that heat is a compound of more simple elements, just as water is a compound of more simple elements, and that the simple imponderable elements of imponderable heat must have as distinct affinities for

ponderable matter, and as contradistinguished as are the well-known affinities of water or its elements for other elements, and, therefore, the newly-discovered properties of "stame," though so wonderful to our conceptions, is no more wonderful than the other distinct properties possessed by the same elements in the foregoing Table.

That heat is a compound of other elements is evident when heat is evolved by combustion, wherein two essentially chemically distinct elements, a combustible and a supporter of combustion, must be present; for from neither of which alone can intense heat be produced, though so abundantly from the compound elements employed.

That heat is a compound of the two different electric fluids appears evident, when they are brought in contact (after travelling any distance over cold wires) they are instantly transformed into intense heat, just as are the different elements of heat in the gases when brought into more intimate contact by an electric spark, or when the solid fulminates are exploded by any blow which brings the opposite elements therein into closer contact.

That heat, light, electricity, and magnetism exist uncombined in immense quantities, in the hardest and coldest bodies in nature, may be easily shown by the following experiment:

Strike a few sparks with a flint and steel held over a sheet of paper. These sparks collected and viewed with a magnifier, will appear of various vitrified forms, of a brown colour, considerable lustre, of different magnitudes, some one-twentieth of an inch in extent, all differing greatly both in form and chemical properties from the colourless fragments of flint with which they are mixed.

Repeat this experiment within a hand-basin filled with cold water, wherein the flint and steel are held while the sparks are struck under water, when the sparks will be found of the same colour, forms, and chemical constitution as those sparks previously struck in air.

Transfer the sparks to a watch-glass, pour over them a little muriatic and nitric acids, apply a gentle heat, and the sparks will be dissolved in a few minutes.

Pour the clear solution into another watch-glass, evaporate to dryness, pour water thereon, and a copious white precipitate (silex) will subside.

Transfer the clear solution into another glass, add a few drops of prussiate of ammonia, and a deep blue precipitate (prussiate of iron) will thus be obtained.

On considering the result, we are assured that, by the collision of cold flint and steel in cold water, as intense a heat has been momentarily produced in that unfavourable situation, as can be produced by the most powerful galvanic battery, under favourable and skilful management, as the heat thus produced under water greatly exceeds that produced in any kind of furnace, having not merely fused, but so perfectly vaporized two distinct masses of flint and steel, that the ultimate and intimate atoms thereof were perfectly separated, or they could not have mutually penetrated and chemically decomposed each other, and recomposed a perfectly new and distinct chemical compound, silicate of iron, or ferruginous glass.

We are certain of these several facts by the silex having become soluble in the acids, undecomposed silex being perfectly insoluble therein, while the decomposition and recomposition of two of the hardest substances in nature being accomplished in less than any appreciable time, by means only of forcible approximation or concussion, whereby intense nacent heat, light and magnetism were evolved, and at the same instant the great tenacity of the substances was nearly destroyed; and as all tenacity of gunpowder or other fulminates is wholly destroyed wherever those substances are exploded, and when heat and light is produced and expelled from such bodies, we have strong grounds for supposing that the tenacity of material substances somehow depends upon the otherwise inert elements of heat and light and magnetism, being in some intimate chemical combination with the ultimate molecules of matter in all solids.

The foregoing observations will also solve a wonderful and mysterious circumstance attending telegraphic electricity—namely, its instantaneous passage; for if metals are what they seem to be, aggregations of loose magnetic metallic atoms, retained in the solid state by being saturated with electricity, in definite atomic proportions, it plainly follows, a metallic wire is also an electric wire in a neutral state, and that the addition of electric fluid at one end of an insulated wire can only be accomplished by the emission of an equal quantity of electric fluid from the other end of the wire, so that the immersion and emersion must of necessity be as instantaneous as intense.

Having seen that steel contains at least one of the electric elements, we can show that solid contains much more space therein for the imponderable elements between the atoms of ferrum, than has been hitherto stated by chemical writers, by whom it has been universally said, that all substances are expanded by heat and contracted by cold, except water when near the point of congelation, which is on the contrary so ex-

panded by cold, that ice becomes $\frac{1}{8}$th part specifically lighter than the water from which it was formed. Notwithstanding this it is very frequently seen in foundries, that cold cast-iron is just as much specifically lighter than fluid cast-iron, as ice is specifically lighter than water; for apparently about $\frac{1}{8}$th part of the solid floats above the surface of the fluid iron, and therefore the solid iron must contain or consist of $\frac{1}{10}$ part interstitial space, for the reception of the imponderable elements we have shown it to possess beyond any other we know not of, but which are probably very extensive from contemplating the state of fluidity in which the greater density is observed.

Here then we have seen enough to conclude that steel and silex are mere exhibitions of all, and only the elements of gases in a peculiar state of condensation, containing in their interstitial spaces all the imponderable elements necessary for their conversion to the gaseous state; but if we consider these imponderable elements have been hitherto merely termed latent heat, that term must now appear most puerile and imperfect, for we cannot help allowing that at least three distinct elements are required to account for the facts observed; namely, heat, light, and magnetic force.

That heat and light are distinct elements is so easily shown by holding a pane of glass before a bright fire, whereby all the heat is stopped, while the light is transmitted. Again; that a most active and intense magnetic force exists, as distinct from heat and light, as are those properties distinct from each other, must be apparent to those who will consider how abundant and energetic must have been the force that could attract innumerable atoms of matter from their original distant positions in flint and steel, and conduct and re-arrange them accurately in their new approximations in silicate of iron, and in less than any appreciable time. Again; when light is observed separated in the spectrum it is hardly possible to conceive that light is not a compound of more simple elements. To be satisfied then that latent heat can be a sufficient cause for, or explanation, of the distinct phenomena, to be observed in operating upon minute fragments of flint and steel, must be discreditable to the humblest intellect.

That heat possesses much greater power of expanding the compound water than it does of expanding the elements of water, is by no means a solitary example of the greater efficiency of heat when acting on compounds than when acting upon the elements of those compounds. We may first point to solder, which fuses far below tin, and much farther below the average of its elements, tin and lead; and a still more striking instance is afforded by fusible metal:

| | | of Specific Gravity | and Fusible Points |
|---|---|---|---|
| Bismuth | 1 | 9·88 | 476° |
| Bismuth | 1 | 9·88 | 476° |
| Lead | 1 | 11·35 | 612° |
| Tin | 1 | 7·29 | 442° |
| | | 4)38·40 | 4)2006° |
| | | 9·60 | 501° |

Average specific gravity 9·53 and melting points 208° were carefully found by experiment.

Having thus shown the insufficiency of any known theory to account for the wonderful properties of heat, light, and magnetism, for the purpose of explaining to the best of our ability the new and useful facts we have disclosed, and which some conceited bookworms have affected to doubt, because it is so contrary to the books from which they have derived all their information, we shall proceed to discuss the subject, and prove our position by other facts.

The Cornish engineers, who have so greatly surpassed Watt and all other engineers, must have employed very superior means, and their practice has progressed so much before theory, that they and all others are unable to explain philosophically the means by which their wonderful achievements have been effected. This circumstance is of itself very unfortunate for mankind, as it forms a great impediment to the general introduction of the advantages they have obtained. We expect to show plainly, not only the occult cause of their success, but far greater advantages may be obtained from that revelation, than the Cornish engineers have or can realize by their most improved practice.

(*To be continued.*)

## PROPOSED IMPROVEMENTS IN COPENHAGEN.

A note communicated by the Danish Consul at Paris is published in the *Moniteur*, offering a premium for the best plans of effecting the following improvements at Copenhagen:—

"For the supply of water to the extent of 100,000 tons in 24 hours, to be distributed throughout the city for various purposes, such as the extinguishing

of fires, the clearing out the drains and cesspools, &c., and to furnish power enough to raise the water in the houses to the height of 90 feet, and to filter the water so as to render it fit for domestic purposes.

"2. For a better management of the gas, so that the number of lamps may be at least triple to what they are at present; and to form a public gas establishment, by means of which private individuals may have the power, on reasonable terms, of having their houses lighted by it.

"3. For the best plan of disposing of the contents of the drains and cesspools."

The plans and designs are to be transmitted to the municipal administration of Copenhagen, within the delay of eight months from 18th February last. The author of each plan, if accepted, will receive a premium of 250 golden Fredericks (5,200f.), and a similar additional sum if one person presents a plan to effect the whole of the objects desired. For any plan adopted in part, a proportionate sum will be allowed. For more detailed information application must be made to the municipal administration at Copenhagen.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 4TH, 1850.

JAMES HIGGINS, Salford, Lancaster, machine-maker, and THOMAS SCHOFIELD WHITWORTH, Salford, aforesaid, mechanic. *For certain improvementss in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials.* Patent dated September 24, 1849.

[The above patent being opposed by caveat at the Great Seal, was not sealed till 2nd Oct., but bears date 24th Sept., the day it would have been sealed had not opposition been entered.]

The invention is based upon certain improvements which formed the subject of a former patent, April, 1845, and relates to a peculiar construction of self-acting mule, to roving and drawing frames, and to the mechanical arrangements for working them.

JOHN MEADOWS, of Princes-street, Coventry-street, Middlesex, carver and gilder. *For improvements in veneering.* Patent dated September 27, 1849.

According to the present mode of veneering furniture, the pieces are laid on successively, and united at the angles. Mr. Meadows proposes to use one piece only, and to bend it over the angles by means of a press. The press consists of a suitable framework supporting a hollow bed-plate, heated internally, by steam or otherwise, the top surface of which bed-plate is shaped to suit the angles and bends of the pieces of furniture. In front of the bed-plate there is hinged a hollow bar, similiarly heated, and above that a second bar is supported. The inner faces of these bars are also shaped to suit the surface to be veneered. The bars are, moreover, provided with levers and other mechanical contrivances, whereby they are gradually made to advance or recede as required. The *modus operandi* is as follows:—The hollow bar is turned down and the veneer laid upon the bed-plate, and above that is placed the article to be veneered, which is gradually forced down by a screw, supported in the upper part of the frame. The hollow bar is next turned up and pressed inwards to bend the veneer to the angle, and then the second bar is similarly acted upon to effect a like purpose. By this means the veneer will be made to assume the form of the article to be veneered, and will be pressed into close contact with every part of its surface.

The surfaces are of course prepared in the usual way to ensure adhesion, and retained in close contact until hard, by means of a clamping iron and pieces. When veneers of a light colour are used, it is proposed to substitute for common glue, parchment cuttings boiled down and thickened to the consistancy of paste with whiting.

No claims are made in this specification.

JOHN MARRIOTT BLASHFIELD, Millwall, Poplar, Middlesex, Roman cement manufacturer. *For improvements in the manufacture of manure.* Patent dated September 27, 1849.

This invention consists in the conversion of river mud into manure by the following process:—The upper crust of mud is collected as being the richest, and removed to a suitable building, where it is mixed with sulphate of lime to prevent the escape of ammonia, and spread upon a floor heated by flues, and dried to the consistency of clay. It is then treated, in a close chamber, with one-fourth of its weight of sulphuric acid, and moistened with water; after which it is dried and mixed with other materials in the following proportion:—

1100 cwt. of saturated mud.
400 ,, superphosphate of lime.
300 ,, sulphate of ammonia.
100 ,, sulphate of soda.
100 ,, sulphate of potash.

*Claims.*—1. The manufacture of manures from mud by subjecting it to artificial heat, and treating it with acid.

2. Combining the materials, before mentioned, or any of them, with mud, when heated and treated with an acid, as described.

WILLIAM BROWNE, of St. Anstill, Cornwall, mine agent, and RICHARD ROWE VEALE, of St. Columb Major, in the said county, gentleman. *For improvements in preparing for pulverization, flint, stone, china-stone, ores, minerals, spars, sands, earths, and other substances.* Patent dated September 27, 1849.

The patentees remark that the pulverization of the various substances enumerated in the title of the patent is a long and expensive process, even though they may have been previously calcined, and that their

invention has for its object to remedy that objection by first heating the flint, stone, &c., to a high temperature, but not high enough to fuse them, and then subjecting them, while at this high temperature, to the action of cold water. Instead of cold water, hot water or steam may be used.

*Claim.*—Preparing for pulverization, flint, stone, china-stone, ores, minerals, spars, sands, earths, and other substances, by subjecting them to a high temperature without fuzing them, and then to the action of water.

WILLIAM EDWARD NEWTON, Chancery-lane, C.E. *For improvements in the manufacture of knobs for doors, articles of furniture, or other purposes, and in connecting metallic attachments to articles made of glass or other analogous materials.* (A communication.) Patent dated September 27, 1849.

The patentee describes and claims the constructing of the metal shanks in the shape of a tube with a longitudinal slit, or with the end closed, and having slots in the side, or with diverging flanges, in order that the metal may be as thin as is compatible with strength, thereby affording a centre vent, offering no obstruction to the crystallization of the substance, and diminishing the chance of fracture from unequal contraction or expansion of the metal and vitrified material.

*Specification Due, but not Enrolled.*

NICHOLAS DORAN MAILLARD, Edward-street, Portman-place, engineer. *For improvements in obtaining motive power for giving motion to machinery, and in propelling vessels.* Patent dated September 27, 1849.

*(No English Patents Sealed this Week.)*

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| March 22 | 2240 | William Wolfe Bonney | Fulham | Safety-boat. |
| 27 | 2241 | W. Kidston and Co. | Bishopsgate-street | Double-action pump. |
| ,, | 2242 | Alexander Grant and Brothers | Clement's-court, Wood-street, London | The "Fleur de Lis Parasol." |
| 30 | 2243 | William Robertson | Glasgow | Mineral discharger. |
| ,, | 2244 | Thomas Dean and Robert Thorburn | Wishaw, Broxburn | Drain-tile cutting apparatus. |
| ,, | 2245 | The Ainslie Brick and Tile Machine Company | Piccadilly | Pipe-socket mould, pallet, and cutter. |
| ,, | 2246 | Frederick Parker | Boston | Signal apparatus. |
| ,, | 2247 | William Harding | New Oxford-street | The Arden clasp. |
| April 2 | 2248 | Frederick Wilson | Leeds | Weighting and driving apparatus, to be applied to the rollers of wool washing, calendering, & other machines of similar construction. |
| ,, | 2249 | Thomas Day & Christopher Martin | Birmingham | Rotary heel for boots and shoes. |
| 3 | 2250 | Thomas Waddington | Manchester | Paragon neck-tie. |
| ,, | 2251 | Samuel Last | Oxford-street, and New Bond-street | Tient-tout or railway portmanteau. |
| ,, | 2252 | Wellington Williams | Gutter-lane | Fastening and band for shirt collars. |

CONTENTS OF THIS NUMBER.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1392.] SATURDAY, APRIL 13, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## FAIRBAIRN'S WROUGHT IRON GIRDER BRIDGES.

Fig. 1.

Fig. 5.

REPORT ON THE STRENGTH, ELASTICITY, AND OTHER PROPERTIES OF WROUGHT-IRON GIRDER BRIDGES, AS APPLICABLE TO RAILWAYS AND OTHER STRUCTURES. BY W. FAIRBAIRN, ESQ., C.E.

*(From the Appendix to Report of the Commissioners appointed to Inquire into the Application of Iron to Railway Structures.)*

THE idea of crossing the River Conway and the Menai Straits on the line of the Chester and Holyhead Railway (two of the most formidable barriers ever presented to the engineer) properly belongs to Mr. R. Stephenson.

To carry this into practice require the united skill of the mechanical as well as the civil engineer; and it is highly gratifying to find that the successful completion of the first of the Conway tubes has not only attained that object, but it has established a new era in the history of bridges by the development of the properties of a hitherto untried material, and enables the engineer of the present day to conquer obstacles which, at no very distant date, were considered insurmountable.

An undertaking of such importance to the scientific world, to the public, and to those more immediately interested, involve heavy responsibilities on the engineer, and before anything definite could be accomplished, it became absolutely necessary to institute a series of experiments to determine the practicability of such a structure, including other inquiries into the proportions and other properties of the tube. At the request of Mr. Stephenson I had the honour of being selected to conduct this inquiry.

Experiments on circular, elliptical, and rectangular tubes were accordingly undertaken; but it soon became evident from the results obtained that those of a rectangular form were best calculated for the purpose. It was not, however, until I had adopted the tube with the corrugated top that the real value of the tubular form became apparent, and, in fact, absolutely requisite in that part to offer sufficient resistance to the crushing force.

I will not trouble the Commissioners with the details of the experiments, but simply state that it evidently became necessary to adopt some other shape than those of the circular and elliptical kind, and so to proportion the top and bottom sides of the tube as to effect a balance of the resisting forces of extension and compression, and thus to ensure the maximum force of resistance in every part. These proportions were clearly indicated by the rectangular form; and the formation of cells on the top side gave more effective powers of resistance to the crushing force than had been heretofore accomplished by the single plate.

This discovery of the cellular top, and the greatly increased value which a tube thus constructed gave to the experiments, at once suggested a modified form of tubular girder adapted to shorter spans. This description of bridge is now becoming general; and from its superior powers of resistance, greater security, and its adaptation to almost every description of span, we may reasonably infer that wrought iron is cheaper and safer, if not equally durable with any other description of material. It may, and I have no doubt it will, be urged, that wrought iron is much more subject to oxidation and decay than cast iron or stone—a circumstance which cannot be disputed; but that can only arise from gross negligence on the part of those having charge of the structure, as two coats of good oil paint, every three years, will effectually protect it, and render it durable for almost any length of time.

Besides, the girders as now constructed are accessible in every part, and, by careful attention, I can see no reason why they should not last 500 instead of 50 or 100 years. Another objection brought against this description of bridge is, the risk of the rivets becoming loose; and from the number of joints, the whole is considered, by some, as dangerous and insecure. Now, as regards this objection, no real weight can be attached to it, as the parties raising it cannot be acquainted with the nature and solidity of the work. It is next to impossible for a single rivet to get loose (unless the work is improperly executed); and, in the whole of my experience, I am not acquainted with any description of jointing so certainly secure and so well

adapted to resist any description of strain as that of riveted plates. I speak practically and unhesitatingly on this subject; and I have only to instance steam boilers, iron ships, and other vessels subjected to severe strains, as examples of the strength and tenacity of riveted plates; in fact, rivets seldom or ever get loose, but retain their position under every species of strain, and become as it were integral parts of the structure in common with the plates themselves.

In submitting these remarks to the consideration of the Commissioners, and in order to bear them out, it may not be uninteresting briefly to notice a few of the results of the experiments illustrative of this subject, and to show, with a greater degree of exactitude, the nature and value of this description of structure. For these objects, I beg to insert a few of the earlier experiments on different descriptions of tubes as recorded in a report addressed to Mr. Stephenson and the Directors of the Chester and Holyhead Railway, the particulars of which have already been before the public:—

[Here follow the details of the experiments referred to.]

The experiments, of which the above is a brief notice, have led to other improvements of great utility in practical science, and probably of equal value with those for which they were originally undertaken.

I have already stated that the difficulty which the weakness of the material to resist a crushing force occasioned, was overcome by the adoption of the cellular form of top; but another, and, to my mind, very serious difficulty presented itself; in the reduction in the strength of the plates at the joints by the ordinary method of riveting, in the bottom and those parts where the tensile strain came into operation. This led to a new system of riveting, which, without weakening the body of the plate to so great an extent as formerly, gives a joint of almost equal strength with the plate itself, and thus adds in a most material manner to the security of the structure.

Consequent upon the experiments, and the results obtained therefrom, numerous advantages presented themselves in the construction of wrought-iron girders. The strength, ductility, and comparative lightness of the material are the important elements of these girders; and their elasticity, retention of form, and other properties, render them infinitely more secure than those composed of cast iron, which, from the brittle nature of the material and imperfections in the castings, are liable to break without notice, and to which the wrought-iron girder is not subject. This is, however, probably of less importance, as the wrought-iron girder will be found not only cheaper, but (when well constructed, and upon the right principle) upwards of three times the strength of cast iron.

I have elsewhere stated to the Commissioners, that the experiments attracted the notice generally of railway engineers, and amongst others that of Mr. Vignoles, who immediately gave an order for two wrought-iron girder bridges for the Blackburn and Bolton Railway Company,—one to cross the Liverpool and Leeds Canal, and the other over the turnpike-road, both in the vicinity of Blackburn. These bridges were constructed simultaneously with another of similar form (with a cast-iron top), executed by Mr. Dockray, under the direction of Mr. Robert Stephenson, for carrying the turnpike-road over the London and North-Western Railway at Camden Town. Those for the Blackburn and Bolton Railway were, however, the first adapted for railway traffic; and although they are probably not so well proportioned as others since constructed, they nevertheless exhibit extraordinary powers of resistance, and conceiving that a description of these bridges, with the tests to which they were subjected, might be useful, I have great pleasure in submitting the same, with the necessary drawings, to the consideration of the Commissioners.—(*See engraving.*)

*Explanation of the Engravings, descriptive of the Hollow Girder Bridge over the Turnpike-road near Blackburn.*

Fig. 1, is an elevation or side view of the girder, each 66 feet long, and bedded on cast iron base plates.

Fig. 2, is a transverse section of the bridge, showing the sides of the cross beams, and the cross sections of the outside and middle girders.

Fig. 3, is an enlarged transverse section of the outside girder, showing the attachment of the cross beams, which are riveted to the bottom of the girder, exclusive of two bolts *a, a,* which extend through the bottom plates and angle iron of the girder, and the top and bottom plates of the cross beam.

Fig. 4, is an enlarged view of a part of the side of the large girder, exhibiting a transverse section of the cross-beam at *b*, which is made of wrought iron, with the top and bottom plates so proportioned as to equalise its powers of resistance to the force of compression on the top, and that of tension on the bottom. It also exhibits the mode of riveting up the joints of the side plates with the covering strip *c, c, c,* and the additional strength as obtained by the attachment of T iron in the interior of the tube.

Fig. 5, is a plan of the bridge, showing on one side the platform and the rails, and on the other the cross-beams, which in this bridge are placed six feet asunder, but in those more recently constructed, I have placed them at distances of only four feet, and consider this arrangement preferable.

From the above description it will be seen that the whole is a strong and perfectly rigid structure. With three longitudinal girders, a bridge of this description will support a load equally distributed of 760 tons; and, in order to render it safe, under every species of strain, the middle girder is made nearly double the strength of those on the outside. This is essential, as two trains may be passing the bridge at the same moment, in which case the middle girder would be subjected to a pressure equal to double the load on the outside girders.

In the construction of bridges of larger span, I generally prefer only two large longitudinal girders with strong cross-beams every three feet, of sufficient length to admit two lines of rails, and sufficient room for two trains to pass at the same time. This mode of construction is preferable to the three girders, as it effects greater simplicity in the structure, and, from every appearance, renders the bridge equally effective and secure.

Having thus described the advantages peculiar to this description of bridge, I will now direct the attention of the Commissioners to the tests to which the Blackburn Bridge was subjected, previous to its opening for public traffic. The experiments were made in the presence of Captain Coddington, the Government Inspector of Railways, and Mr. Flannagan, engineer of the line, as follows:—

Three locomotive engines, weighing 60 tons, were coupled together, and passed over the bridge at velocities varying from 5 to 15, and 25 miles an hour. This load (60 tons) produced a deflection of ·025 of a foot, or about three-tenths of an inch, and that without any perceptible increase in the deflection arising from the different rates of speed. In fact, the deflection was found to be the same at all velocities.

After these tests were made, two wedges or inclined plates were fitted to the rails, as per annexed sketch, at the middle of the bridge, and the engines run over them at the rate of 8 to 10 miles an hour. The shock of the engines as they respectively


fell upon the girders, from a height of one inch, the thickness of the wedge at *d* gave an increase deflection from ·025 to ·035 of a foot, and another set of wedges, 1¼ in height, gave a farther increase of deflection (at the same velocity) of ·035 to ·045 of a foot.

From the above experiments it appears evident that wrought-iron girders are well calculated to resist not only a heavy dead weight, but the force of impact administered with an unsparing hand; for, in fact, the girders were not injured by the blows inflicted by the engines falling a height of 1¼ inches upon them, but restored themselves to their original position from which they were deflected by the shock.

On the whole we may, therefore, reasonably conclude that the present structure is not only the strongest, but the best calculated to resist strain when applied to large spans, and particularly in situations where bridges with a perfectly horizontal soffit are alone admissible.

(Signed) WILLIAM FAIRBAIRN.

Manchester, April 26, 1848.

## APPLICATION OF MANUAL FORCE TO THE PROPULSION OF SHIPS OF WAR.

[From the unpublished MSS. of the late Brigadier-General Sir S. Bentham.]

That it is possible to employ the force of men to giving motion to large vessels I have experienced most successfully; but it was by an arrangement far preferable to the usual mode of immense oars, requiring several men to each oar.

The galleys originally built for the use of the Empress Catherine II. of Russia, were afterwards put under my management to be fitted for war: when put into my hands they were each of them furnished with twenty-four heavy oars, with three men to each oar to work it; consequently the force of seventy-two men was employed for giving motion to each galley. My observation of the very disadvantageous manner in which the force of men acting with such oars must unavoidably be employed, led me to alter the mode of rowing in two of these galleys; especially as they were now destined for service at sea, and as in rough water it becomes necessary to vary the motion given to oars, the better to avoid impediments arising from waves.

The manner in which I altered the two galleys was that of putting one man only to an oar, and so as to enable him to employ his exertions to good effect; and instead of the 72 men to 24 heavy oars, I reduced the number to 56 men with 56 light oars.

In order to ascertain the advantage of this alteration, I caused one of the galleys in its original state to be manned with its 72 rowers, and one of the altered galleys with its 56 rowers; they were then set to row against each other, and I offered to the men of the swiftest boat a premium of sufficient value to ensure their exertions. In this experiment the galley rowed with 56 men at single oars, went in the same time twice and a half the distance of that with the heavy oars, though the latter was rowed by 72 men.

In order to ascertain that this great difference in velocity had depended on the oars, not on the men, I changed the men reciprocally from one of these vessels to the other, and repeated the rowing-match, when the superior velocity of the vessel with single manned oars, proved the same as in the first experiment.

This experience appears to me the more deserving attention, since the superior effect was produced, not by any extraordinary machinery by which it might be imagined such a difference had been obtained, but merely by a better arrangement of the seats, the rowlocks, and the stretchers, so as that by these alterations the men were enabled to apply their forces in an advantageous manner, and with comparative ease to themselves in rowing.

The alterations above mentioned, differed but little, from the manner of rowing the boats furnished to British vessels of war, or from that in which a boatman generally applies his force, in rowing his wherry on the Thames.

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In another paper Sir Samuel says, "Although it be advantageous to employ steam for propelling packets and many merchant vessels, and in some cases vessels of war, yet in many instances it would be desirable, instead of steam, to provide means for giving motion to the vessel by the force of man. Though the speed thus given, were in a degree much inferior to that requisite for speedy general navigation, yet it might enable a vessel to be freed, though it were but slowly, from a variety of partial impediments or danger; a temporary calm, for instance,—the passing under a headland, or the working off from a lee-shore, a reef, or sunken rock; or in ships of war, the overtaking a flying enemy, or the obtaining an advantageous station for action. Indeed for war purposes, such an occasional application of the force of the crew seems particularly eligible, the number of men on board a vessel of war being always so considerable; and so it

is in transports conveying troops. It may be observed, too, that in such vessels the exercise of giving them motion, would relieve the men from much of that listlessness so annoying in voyages of any long duration." Elsewhere he alludes to the great expense incurred by steam navigation, which must ultimately, from economical considerations, lead to a diminution of the steam navy, unless for the few services where speed would compensate for considerable expense.

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The expense of a steam frigate compared to that of a sailing frigate is brought to view by the "Select Committee on Navy Estimates, 1848." It is stated, p. 704 of the Appendix to their Report, that the *sailing* frigate, the Thetis, of 36 guns, 330 men, costs per day in pay and provisions to the officers and men, 42*l*. 4s. 5d., and in wear and tear of hull, masts, and yards, &c., 22*l*. 18s.; together, 64*l*. 17s. 5d. per day—That a *steam* frigate, the Terrible, of 21 guns, yet of about the same weight of armament as the Thetis, but of lesser number of men, 320, costs per day in pay and provisions, 44*l*. 5s. 2d.—that the Terrible costs in wear and tear of hull, masts, yards, and &c., 25*l*.; together, 69*l*. 5s. 2d. per day. To the 69*l*. 5s. 2d. daily expense of the Terrible is added "wear and tear of machinery and consumption of oil, tallow, &c., 19*l*. 11s. 2d. per diem; altogether 88*l*. 16s. 4d.,—thus there is an excess of no less than 23*l*. 18s. 11d. in the daily cost of a steam frigate, over that of the sailing frigate, when the steaming apparatus is not put to use; so that the difference of cost between the two, amounts to no less a sum than 8,740*l*. 4s. 7d. per annum, independently of coals. When the steam is employed, 4*l*. 5s. 6d. per *hour* is to be added to the extra cost of the Terrible, which, though she were to steam on an average less than 10 hours of the 24, would add another sum of about 15,000*l*. a year to the before-named 8,740*l*. 4s. 7d.; making altogether the extra cost of a steam frigate not less than 23,740*l*. 4s. 7d. per annum.

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## ON THE CAUSES OF THE EXPLOSION OF STEAM BOILERS AND OF SOME NEWLY-DISCOVERED PROPERTIES OF HEAT. BY MR. JAMES FROST, OF BROOKLYN, NEW YORK.

(Concluded from page 278.)

That they have obtained great advantage from improved boilers, with extensive surfaces giving time for the absorption of heat from the heated smoke, which being a non-conductor of heat, parts with its heat slowly; that they have obtained great advantages by husbanding the heat so obtained by incasing their boilers and cylinders with substances almost impervious to heat—are circumstances of considerable account: but still all those matters can constitute but a fraction of their great achievements, and their peculiar use of high steam in Watt's steam-jacket, (an appendage which marine engineers superciliously overlook, though its employment is both indispensable and invaluable,) will soon be found the greatest cause of the benefits the Cornish engineers have conferred on mankind.

Engineers in general consider that the value of a steam-jacket consists alone of protecting the cylinder from the cooling influence of the air, or loss of heat by radiation, and have superseded it by incasing the cylinders of the best engines in felt and wood; now we shall presently show this proceeding is just as irrational and unintellectual, as incasing a hungry starving animal with flannel, instead of supplying it with food.

For first may be seen, by referring to our diagram No. 1, how sensibly expansible (and therefore sensibly condensible) is steam by a minute addition of heat, just at the period the water assumes the elastic form, and, therefore, how greatly will the initial volume of steam be then affected by a minute addition or subtraction of heat. This being premised, it will become evident, that a steam-jacket is not only required to confine heat to the cylinder, but to continually furnish a supply of heat to the cylinder, so that the cylinder may in its turn furnish a continual supply of heat to the steam, while it is expanding within the cylinder, and thus greatly increase both its volume and tension at little cost, which we have already shown it to do by the small quantity of heat required for the conversion of steam to stame.

The main attempt of the Cornish engineers has been directed to obtain a greater duty by the employment of denser or hotter steam than Watt employed, and in order (as they thought) to derive greater mechanical ex-

pansion, and there is little doubt they still congratulate themselves in having, by that (inadequate) means alone, so greatly succeeded; but the secret of the matter is, they have at the same time derived another and greater benefit from the chemical expansion or conversion of steam to stame, and having thus realized more than a double advantage, they may, might, and ought, to have suspected this occult cause of their success.

That great philosopher, Boyle, justly observed, long ago, that if persons would disclose failures as well as successes, science would progress far more rapidly. Following his advice, we will detail an error that will show both the need and value of a steam-jacket, more than any argument we can employ.

A horizontal high-pressure steam-engine, having a cylinder 12 inches diameter, five feet stroke, the steam employed unexpansively, was altered (with the sole view of saving fuel) to an expansive engine, by exchanging the cylinder for one of more than 20 inches diameter, and, therefore, of three-fold capacity. The workmanship was perfect, but the profit very small.

We lately examined this engine (which is kept in constant work), by cementing some one-sided wood cups to different parts of the side of the cylinder, and having filled those cups with fusible metal, which being in contact with the side of the cylinder, served to heat different thermometers to the same temperature as the different parts of the cylinder to which the fusible metal was applied.

When the engine was using steam of 75 lbs. per inch above atmospheric pressure, and therefore = to 90 lbs. per inch, and temperature above 320°, while the steam was cut off at from $\frac{1}{4}$ to $\frac{1}{5}$ stroke. The temperature of the ends of the cylinder, (which were alternately supplied with steam of 320° every third second of time,) was found to be only 252°, and the temperature of the middle part of the sides of the cylinder was found to be only 212°; we also found on opening a cock, inserted into the head of the cylinder, that the air rushed into that end of the cylinder while it was filled with the expanding steam therein, and at or before half the stroke of the engine had been accomplished.

When it is considered that the density of the initial steam was such that the expanded steam ought to have had a greater tension than the atmosphere, and a greater temperature than 212° at the termination of stroke; the want and value of a steam-jacket to this engine must be apparent to the dullest capacity, and yet no marine engine we have yet seen, is furnished with such an appendage!

Now we have shown why the Cornish engines are so vastly superior to all marine and manufacturing engines, we will next show how those latter engines may be caused as greatly to surpass the Cornish, which, being high pressure, and very high pressure engines, would be too dangerous for navigation, but more especially (be it particularly observed) that by the use of low steam converted to stame, both the greatest safety and greatest profit must be found connected; because the reasonable heating of either high or low steam (for conversion into the more profitable stame), must terminate at the same degree, it follows then that double profit will accrue from converting low steam to stame, because high steam of itself has been already so heated as to be incapable of more than half the profit to be derived from heating low steam.

Having shown whence the Cornish engines have derived their vast superiority, that has so astonished the most eminent engineers, by the treble or quadruple duty, and which has appeared, as Mr. Palmer stated, both incredible, impossible, and incomprehensible; and having as plainly shown that by heating steam apart from water, steam having but little capacity for heat, is greatly expanded by a very inconsiderable additional quantity of heat, becomes a distinct and chemical compound of heat and water "stame;" having shown that by its production from low steam, it must become far more profitable than from high steam; having also shown, that from no other source can the present superior duty of the Cornish engines be derived—we shall take leave of this part of our subject by stating, that we have realized a duty of more than eighty millions from the use of stame in the condensing engine before described, whose cylinder was only six inches diameter, unprovided with any steam-jacket or other apparatus for expanding steam, by which means the duty would at least have been doubled, and in what a Cornish engineer would consider but a toy; which nevertheless shows the present general use of fuel for the production of motive force to be so inefficient, extravagant, and wasteful, as to be discreditable to the age.

In conclusion, we beg to announce the work as but half completed, so many important matters remaining unnoticed, and so many glaring errors and misrepresentations uncontradicted and unexposed.

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*Appendix. February*, 1850.

Having seen the thermometrical degrees at which steam, apart from water, is expanded by heat into larger volumes, it becomes important to learn the actual quan-

tity of heat required for each degree of expansion, and the apparatus represented by the following diagram will show; first, how small is the quantity of heat required for doubling a volume of steam apart from water, when compared with the quantity of heat required for forming a second volume of steam of the same tension; and, secondly, shows that heat in combining with steam is subject to, and controlled by, peculiar laws, perfectly distinct from those which obtain when heat combines with water for the formation of steam, which requires equal increments of heat for equal increments of volume, while, on the contrary, when steam apart from water is expanded by heat, it is not only doubled in volume by a comparative trivial quantity of heat; but every additional increase of volume is obtained by a still smaller and rapidly-decreasing increment of heat, so that the greater the increase of volume, the smaller will be the quantity of heat required for that latest volume; and although this is so contrary to the general laws of heat, and therefore so adverse to common apprehension, the Diagram and Table will not only show it to be a chemical fact, but will furnish the easy means for any competent person to verify the fact, which must be acknowledged to be of the first importance; for, were these facts understood, the present cost and weight of apparatus, and of fuel for the production of motive force, would both appear so extravagant, unscientific, and wasteful, as was the use of steam for motive force, before the days of Watt; yet, at that period, as at present, engineers conceited they fully understood the subject, "*oft attempted—never reached.*"

Though it requires four times the force for double speed, it is evident were the present enormous rate of fuel consumed in steamers judiciously applied, it would furnish abundant power for propelling them at much more than double speed, while the consumption of fuel for the voyage would, of course, be reduced to much less than one-half.

A, furnace and steam boiler suspended over it. B, furnace and suspended steam heater for containing fluids, boiling at stationary temperatures, and hollow worm,

connected by a pipe and stop-cock with steam boiler A, and by a pipe with worm in C. C, a covered wood cistern, containing half a cubic foot of cold water and hollow worm therein.

When a volume of steam from A was passed through the hollow worm in heater B (filled with water boiling at 212°), and into the hollow worm in C, until the condensed water therefrom exactly filled a glass measure containing nearly twenty ounces of water. The heat separated from that definite volume of atmospheric steam heated the water in C 38°.

When similar volumes of steam from A were passed through the worm in heater B, while the contained fluid was heated to the more elevated temperature in the Table, the excess of heat in each case above 38° showed the decreasing quantities of heat required for increasing the original volume of steam to the magnitude stated in the Table.

| Temperature of boiler A. | Temperature of heater B. | Volumes of steam and steams produced at those heats shown in former experiments. | Temperature of water acquired in C, showing the different quantity of heat in different volumes of equal tension. | Comparative quantity of heat required for equal volumes of steam of equal tension. | The quantities of heat in 4, 5, 6, 7, 8 volumes being fractional, were incapable of exact definition, the 5 volumes requiring but 3·38 the quantity required for 1 volume steam. |
|---|---|---|---|---|---|
| 212° | 212° | 1 | 38° | 38° | |
| 212° | 216° | 2 | 42° | 76° | |
| 212° | 228° | 3 | 46° | 114° | |
| 212° | 550° | 8 | 46° | 304° | |

This increasing force obtained from decreasing quantities of heat applied to steam apart from water, not only proves the prodigious economy of this means of obtaining

motive force, but points out the physical cause of the superlative explosive force, attendant on greatly and suddenly heated elastic fluids.

Many other and valuable advantages incidentally occurred during our experiments, which are omitted, because enough is given to stimulate the most torpid. We will, therefore, only add—

The following advantages have been frequently verified by several of the most eminent engineers and learned and competent men of New York and other places, by a condensing engine and apparatus so constructed, when actuated alternately by common steam, and by moderately-heated steam, so that the comparative quantities of heat and of water actually employed for motive force in each separate experiment, could be accurately measured as well as the power exerted by the engine.

The general results showed, that more than six times the motive force was realized from equal quantities of heat and of water, when employed to actuate the engine with heated steam or stame, than was obtained from the use of natural steam—each being alike produced from the same constant fire and time, and the same engine; which engine, apparatus, scientific instruments described in this work, and testimonials of competent and respectable engineers, are open for inspection in Fulton Avenue, near Gold-street, Brooklyn.

James Frost.

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Page 255, first column, read for one-third part, one-seventh part of a second.

## THE EXHIBITION OF 1851.

(From the *Brighton Guardian.*)

Sir,—I have been informed, upon good authority, that the plan of an Exhibition of the Industry of all Nations was steadfastly resisted by two successive administrations; and it may now be said to have originated in a kind of *conspiracy of some five or six members of the Society of Arts in the Adelphi*, who, in the name and under the patronage of His Royal Highness Prince Albert, have at length succeeded in foisting this gigantic imposition upon the public, and themselves into a lucrative employment. At present we are in a state of transition from the protective system to a more sound and healthy one; but free trade we have not yet obtained. Are not the productive classes in this country still compelled to contribute an enormous and most unfair proportion towards the annual expenditure? True, the tax upon the staff of life has been repealed; but other necessaries are still heavily taxed; tea, for instance, some 500 per cent., beer, tobacco, the only luxury of the working man, upwards of 1000 per cent.; and yet Mr. Wagner and the Bishop of Oxford have the assurance to tell the working classes that the admission of the produce of the French and German manufacturers *duty free*, and the exhibition of their wares (*i.e.* opening shop), in Hyde-park, under Court patronage, is for their especial benefit. If this forced or sudden introduction of continental prices be so very advantageous for the working classes, let the same rule be applied to the church. If the working man is thus suddenly to be reduced to the lowest wages, why not also the lazy, turbulent priesthood—not the meek and charitable working clergyman, but the parish firebrand and Romanising bishops who oppose the diffusion of knowledge unless it be diluted and corrupted with their Popish doctrines?

*If* this Exhibition ever take place, it *must* be adjourned for a year or two, say, till the year 1853; time must be given for preparation. In this Royal Commission, or rather *omnium gatherum*, which is composed of the most heterogeneous materials, some dillettante is expected to rectify the errors in judgment (on sculpture!) of Sir Richard Westmacott or Mr. Bailey, while Mr. Cockerell, the champion of Greek architecture, is required to co-operate with the representative of the modern manufactured Gothic style. Commissions thus constituted, without individual responsibility, forcibly remind one of the truth of Lord Thurlow's oft-quoted remark on corporate bodies, "That having neither a back to be horsewhipped nor a soul to be d——d, they will do or suffer any thing." The Royal Commission issued for the purposes of decorating the Houses of Parliament commenced by proclaiming the principle of *free competition*—the names of competitors to remain unknown till after the prizes had been awarded. This system, however, did not work well; the *right* men did not gain the prizes; and so the competitors were desired to send in their "name and address." Still the *judges* were just. The same artist, Mr. Armitage, again carried off the first premium, and, of course, immediately received a commission? No. An artist, patronized by His Royal Highness Prince Albert, who had never gained a single prize, was selected to paint the first *model* fresco in the House of Lords, which Mr. Eastlake, the Secretary of the Commission (in a printed report) had the coolness "to recommend the other artists" to imitate. Subsequently, Mr. Dyce received a commission of 800*l.* a year (a favourite sum, apparently, with Royal

Commissioners), for four years, for decorating the Houses of Parliament. Mr. Armitage, the successful prizeman, was *entirely passed over*, while his rival was crowned with academic laurels by the Court sycophants of Trafalgar-square. Already I find that the proposed competition for designs for the reverses of the medals to be distributed in 1851 is to be conducted on the same plan. There are to be the same paltry prizes, the same *dodge* of suppressing (in the first instance) the names of the competitors till *after judgment*, the same twaddling notices, which are absolutely redolent of the shop in Bond-street. But it is not by such childish measures as these, it is by cultivating the higher arts of design and composition, that we may hope to improve the taste and skill of the mechanic, by giving him every facility for studying the *model* works of the Greek artists of the age of Pericles; from these works he will learn to appreciate the difference "between what is barely good, and what is truly excellent."

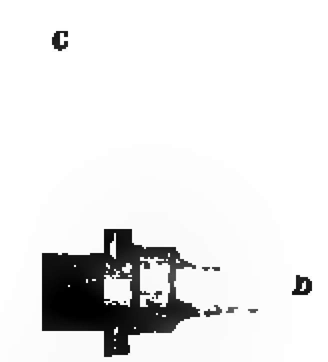
While some of our local charities are languishing for want of sufficient funds, we are urged to fling our money *into the hands of irresponsible persons, without any real security whatever that it will not be devoted to the worst purposes of jobbing and corruption.* I entreat my fellow townsmen, therefore, to reflect before they subscribe their money for any such purpose. "Charity begins at home," and I venture to predict, that before long this great bubble of 1851 will burst, and resolve itself into its primitive suds.

* * * *

I have the honour to be, Sir,
Your obedient servant,
William Coningham.

April 1, 1850.

TILLEY'S PORTABLE FIRE PUMP.




As the early application of a few gallons of water at the commencement of a fire is more effective than many tons afterwards, Mr. Tilley, the well-known fire-engine maker, has lately introduced a fire pump, represented in the annexed engraving, which has been found of great service by the London Fire Engine Establishments; many fires have been already extinguished through its instrumentality. It is particularly suited for warehouses, as well as shops and private dwellings, as it can be worked from a bucket or any other vessel containing water, the whole of which, by means of the hose and jet pipe can be driven with force upon the fire, although it should be behind skirting, against hanging drapery, or under flooring boards. The damage done to furniture, and the great loss of water by its being thrown from buckets, is thus avoided. Another very desirable object attained by the use of this simple instrument, is that of keeping premises cool in the immediate neighbourhood of a fire, and consequently preventing the flames from spreading. As a garden engine, it will also be found to be extremely valuable, being independent of any fixed cistern.

## *Description of the Engraving.*

The engraving represents a sectional elevation of the pump. A is the air-vessel in which is enclosed the barrel and delivery valve. To this vessel is affixed the screw, B, for attaching the hose, C, and jet pipe, D; E is the suction piece, with its valve and strainer; H, the handle and rod; K, a screwed joint, by which the joint can be taken off and both valves examined.

The air-vessel, barrel, and valves, are made entirely of brass. The quantity which this pump can discharge is six gallons per minute, to a height of 30 feet.

## BROWN'S PATENT FUMIGATOR.

(Patent dated September 13, 1849.)

Fig. 1.

Fig. 2.

Fig. 1, of the above engravings, is an external elevation; and fig. 2, a cross section on the line *a*, *b*, of a portable instrument suitable for fumigating plants. A is a magazine similar to the bowl of a smoking pipe, which is made double cased, with air-holes at top, and has a lid, or cover, B, to open and shut. In this magazine is placed a tray, or diaphragm, made of perforated metal or woven wire, to hold the tobacco or substance intended to be used for fumigation. The magazine A is placed on the cylindrical chamber D, with which chamber it has a communication by means of the pipe or tube E. The chamber D, is traversed by the shaft or spindle F, which has its bearings in the sides of the chamber D, and which is made to revolve by having affixed to one end of it the pinion G, which pinion receives motion from the wheel H, revolving on a separate axle, and to which wheel a handle, I, is attached, in order that it may be turned by hand. On the spindle F, is placed a fan, or wind-wheel, G′, having its vanes, or leaves straight, or of any suitable curve, or set at any angle, which, when rotating will cause a draught, or draw the smoke of the tobacco when ignited, in at one part of the chamber D, and drive it out at the other. That part of the chamber D, where the smoke can be best drawn in is near to, and on a level with, the centre of the fan G′, and therefore the pipe E, leading from the bottom of the magazine A, is made to terminate at that part, while, on the contrary, the part of the chamber D, where the smoke can be best driven out, is near, and on a level with,

the circumference of the leaves of the fan G′, and therefore the pipe E, leading from the bottom of the magazine A, is made to terminate at that part, while, on the contrary, the part of the chamber D, where the smoke can be best driven out, is near, and on a level with the circumference of the leaves of the fan G′. Accordingly the pipe, or nozzle L, through which the smoke issues, is placed in the circumference of the chamber D; M is a curved pipe, which fits on to the pipe L, and may be turned upwards, downwards, or sideways, according to the direction in which it is desirable the smoke should issue. The curved pipe may be removed when required. The fan is also intended to draw in cold air to mix with the smoke, which it will do through the valve N; O is a handle, by which to hold the machine whilst operating, and PP, are feet for the instrument to rest upon when not in immediate use; R is a recess in the bottom of the chamber D, for the reception of the oil and dust from the tobacco, and which is fitted with a moveable cap, which may be removed in order that it may be cleaned out when required.

The smoke being thus drawn first into the chamber D, and afterwards driven out therefrom, it is cooled by coming in contact with the cold sides of the machine and mixed with the air, and thereby is rendered harmless to the plant.

## THE DRAINAGE OF LONDON.

It would appear to be settled by the authorities that the Thames is to be used for the drainage of London. A most valuable and striking condition connected with the river for this purpose seems nearly, if not entirely, lost sight of:—I allude to the natural condition of the two hours' extra run of the tide down the river.*

You published, a short time since, a letter from Mr. Hann, of King's College, adverting to a suggestion of mine for taking advantage of the two hours' extra run of tide for the more perfect drainage of London by the Thames. Certain calculations connected with the method of accomplishing this, showing that the practical difficulties could easily be overcome, were submitted to that gentleman for investigation. Subsequent inquiries have been made in corroboration—together with some more recent experiments, to obtain further data—all of which go to prove that there are no existing difficulties that may not be vanquished. Will you permit me, through your columns, to call further attention to the subject?

Any one who will turn his attention one minute to the condition of the river, must see, that only the sewage which runs into the Thames at high water, or soon after, is carried away never to return. All sewage run into the river after this period meets the upcoming tide, and by it is brought back again to London. Supposing the rates of current to be the same up and down, the time being five up and seven down, and the discharge being constant, and of the same impurity, it is manifest that two-twelfths only of the pollution is ever carried clear out of the river by each tide. The discharge from the sewers, unfortunately, on the south side of the river, and also in most parts of Westminster and Pimlico, cannot run into the river constantly; for long before high water, and for some time after, the rise of the river dams up the sewers, and no discharge takes place. Consequently, the greatest part of the filth goes into the river shortly before and after *low water*:—at the very period when of necessity it must be met, and immediately brought back by the uprising tide. It follows, therefore, that this two-twelfth is not two-twelfths of the filth of London, but only two-twelfths of a mere solution:—hence the present filthy state of the river.

Anything of less or of the same specific gravity as water thrown into the river at high water, or within two hours after, it is self-evident, would be carried away by the ebb tide as effectually as if run into a caisson and floated down: but anything run into the river *at low water, or within five hours of low water*, will certainly be brought back again. Yet, so far as the public are permitted to be informed, there is no intention on the part of the authorities to take this fact into their consideration. Between the tunnel scheme for taking the sewage to the Nore, and that of pumping it over the land as manure—the two propositions entertained by the late Commissioners—there seems to be a compromise. The south side is to be taken part of the way to the Nore—namely, to Deptford; that is, it is to be taken to Deptford by tunnel, and brought back by the river. Westminster sewage, it is said, being probably more rich in fertilizing properties, is to be pumped over the market gardens at Fulham; and what cannot be so disposed of is to be run into the river at low water—it will not run in at any other time. There is evidently no intention of

* See *Mech. Mag.*, vol. li., p. 463.

lifting it so as to discharge it into the river at high water. In a letter in the *Times* of the 27th of December last, it is stated by an eminent engineer, who knows the plans of the authorities, and referring to the advantages of carrying the sewage to Deptford, that it can there be "*naturally* drained between the intervals of high and low water." Then, surely there can be no intention of using *artificial* means of lifting and sluicing. The level at Deptford is lower than at London Bridge—and it is evident no sewage can be "naturally drained" at, or near, high water: it therefore is intended to let it run into the river at low water. The *Times*, in a leading article on this point, says, and we must presume with authority—"it is not intended to use intermittent discharge." Of course, if there is to be no interval discharge, it must be continuous. Surely the public have a right to protest against this. It is certain that any sewage run into the Thames at Deptford, at a time when the levels will permit, if naturally to be discharged, will come back again to London *doubly* charged with filth. The common laws of hydrostatics tell us that the sewage from the great mouth at Deptford would continue to pour itself into and increase the pollution of the returning water until the tide was sufficiently high to overbalance the outrun and pond it back in the mouth of the tunnel!

If the public are told, "the authorities intend to lift and sluice it into the river at high water,"—they have a right to ask, "Why put us to the great expense of carrying it to Deptford?" It may be lifted and discharged as cheaply and effectually at London.

Something has been said about the advantage of concentrating the effluvia, and the importance of taking it away from London to Deptford; there may be advantages, or there may not, in taking the effluvia to this spot;—and as it is a matter to which I have had my attention particularly drawn, in consequence of my late experiments on the ventilation and decomposition of gaseous sewage in Friar-street, I will venture to make one or two observations on this part of the subject.

On the continent they lately collected the sewage exhalations, or effluvia, to one spot, and attempted to decompose it *in situ*. At Paris and at Brussels they tried to destroy it by passing it through a fire—a furnace-fire at the base of a high chimney. In both places they failed. They found that the gaseous sewage was not decomposed by this process; it fell from the top of the tall chimney in the immediate neighbourhood, and made the nuisance greater than before. It was therefore abandoned. The fact of its falling undecomposed, particularly in some states of the weather, was not all that was proved in these experiments;—the effluvia was found to lie along the ground, and move in volumes by the action of certain eddies or currents of air. A current of air from Deptford to London is often established by the flow of the river. To concentrate, therefore, the sewage at Deptford may be found inconvenient. This, however, is a point not of much consequence; for, notwithstanding that on the continent they have failed in decomposing gaseous sewage, we have practically succeeded here. The steam jet is now decomposing, according to the evidence of James Mather, Esq., before the late Committee in the House of Lords on Ventilation of Coal Mines (see par. 3716, page 354), "when in full operation, about forty three tons of muriatic acid per week, which were previously nearly all sent into the atmosphere to the injury of life and destruction of vegetation." In the experiments in Friar-street, above alluded to, made with a view to the decomposition of pestilential effluvia arising from sewers, it was proved that it could, at little expense, be most perfectly effected. The use of the steam jet, and the process of decomposition, are open to the public. I have no patent—nor ever had one for the steam jet, or for the mode of decomposing. With reference to the practicability of decomposing gaseous sewage by its agency, it will be well to say, that the facts and details of the process are in possession of the Commissioners of Sewers; they are there on record, together with a vote of thanks to me for my exertions. These experiments were made on public grounds, at the time when cholera was making fearful ravages in the locality, and Friar-street sewer was thoroughly ventilated by the steam jet, and the disease stayed, when all previous attempts had failed. The success of the experiments naturally encouraged me to direct my attention to the general question of the drainage of London; and I am desirous to state this much here, because it has been said—"a gentlemen living 200 miles away, fully occupied in country pursuits, can know or feel little about this matter, and actively engaged as a magistrate in two counties ought to have something better to do than mix himself up with the London sewers;"—"meddling with things that do not concern him."—The well-being of our great metropolis is a matter which concerns every one.

The deposit of mud in the river is a question of some importance bearing on the drainage of London by the river. It is thought by some that the deposit must always go on, and that if the sewage be

carried away by tunnel or otherwise, the deposit of mud would still take place, and that by the flow of the tide it would be disturbed and carried up and down, polluting the river. This need not be:—the conditions on which deposits in rivers depend need not exist in the Thames. No precipitation need ever take place;—any one who has studied the laws of currents and retrograde eddies, and determined the points of quiescence and precipitation, must see that no deposit need take place in the Thames under simple arrangements. The dark lines of sewage seen streaking along the sides of the river are occasioned by the eddy current which always takes the sewage as it comes from the drains in an opposite direction to the flow of the river. When the river is running down, the sewage is running up. Between the direct and the retrograde currents there is a point of rest, —and here it is that precipitation takes place. Destroy the retrograde currents, and you destroy all deposit—whether of sewage, of mud, or of anything else lightly held in suspension. This is a subject requiring more detail than can I fear be gone into here. I will therefore conclude by observing, that if the sewage is sluiced into the bed of the river, from a proper level, *at or within two hours after high water* at London Bridge, *the Thames will then be as pure at London as it is now at Richmond:* that it has been shown by fair calculation on received data, that a single Cornish engine of 60-inch cylinder will lift all the sewage on the south side of the river sufficiently high and in time to be run in at the proper period; but if the sewage be allowed to run in only when the natural levels will permit, whether at Westminster or at Deptford, the filth of the river will always be as bad as it is at present;—that *it is in our power to destroy all pestilential effluvia*, whether arising from gully-holes, from mouths of sewers, or from any other place, at little expense—and also *to prevent the deposit of mud*. The public have a right to ask for these things to be done.—I am, &c.,

GOLDSWORTHY GURNEY.

Bude, Cornwall.

P.S. Since writing the above, I observe it stated in the *Times*, that my plan sent in to the Commissioners was to drain London "*only at ebb tide.*" Now, I neither said nor did any such thing. I sent in no plan to the Commissioners. I suggested in a letter some time since, that the sewage, to keep the river pure, should be run into the tide "*at or near high water.*" I hope similar mistakes have not been made in the construction of other suggestions sent to them on this matter. G. G.

*Athenæum.*

### NOVELTY IN PRINTING.

On Saturday, the 9th of March, an exhibition took place, at Paris, with the new Rotary Press, which is worked by cylindrical motion, and by a stereotype obtained from several sheets of paper made in a pulp, which gives more depth than is usually obtained from plaster of Paris; and the printing is so perfect, that even maps are reproduced from these cylindrical stereotypes with the minutest accuracy. The invention is of a Mr. Worms, for many years a printer in Paris; it is patented in England and all over the continent, and the exhibition took place in the large factory of Mr. Coster, in Paris, in the presence of magistrates and other authorities, and amongst them, the Directors of the Society for the Encouragement of Arts and Sciences: there were also present several of the principal printers, with the proprietor and printer of *Galignani's Messenger*. All testified their satisfaction and admiration on what they saw; the stereotype cylinder was got up in exactly fifteen minutes, and the printing on both sides quite perfect; the speed was 15,000 copies per hour, which can be augmented by corresponding steam power. The rapidity is owing to the printing on endless paper, not wetted, put on rollers; each copy is cut off with mechanical precision. The paper which was printed at this meeting was the journal *La Presse*, but the same number of copies of the largest English journal can be produced by increasing the size of the rollers. The questions put by practical printers as regards the working of the machine and possible accidents, were all fully solved satisfactorily, and it was generally admitted by all parties that the whole was superior to anything in existence, and that the simplicity of the process, together with the considerable economy, must form a new era and a complete revolution in printing in general. Such was the expression of Mr. Lenormand, and Messrs. Firmin Didot, of European celebrity; as, besides the rapidity, the economy in types is very considerable; it is only used on the pulp for the forming of the stereotype, and not worked afterwards, which is the case on all machines in use at present; whereas the new machine occupies small space, is simple in its construction, and of greater production than the American machine, or the one of the *Times* journal. The cost price is considerably less than those already mentioned. The journal *La Presse* has given the first order, and is so well satisfied as to have ordered a sufficient number for the entire adoption in their establishment, five men, of which two adults will do the same work as fifteen men did formerly.

Presses of smaller dimensions, worked by

hand labour, can be supplied at moderate prices.

The Messrs. Galignani have permitted the inventor to use their name as reference, and further particulars may be had of Mr. Hillou, 10, Bedford-street, Strand, London. —*Circular.*

THE "FACTORY" TEN HOURS' ACT.

Sir,—Your correspondent, "A. H.," (p. 264) has forcibly brought to view many evils consequent on over-prolonged employment of women and children in factories; and his having called attention to the fact, that by these means the wages of men are lowered, may prove of much use. Papers in the *Morning Chronicle* on "Labour and the Poor," exhibit, that in all trades, the effect of the employment of women and children in the place of men has been the same, often lowering the earnings of men in a ratio far exceeding any diminution that has taken place in the pay of factory men. To what amount women and children should be employed in manufactories—in what description of them—or whether females and children should be so employed at all—seem questions in political economy, of a nature far too complicated for discussion, in the space that could be afforded for it in your usefully-filled columns; but it may just be observed, that on examination, it might probably turn out, that married women would be more beneficially employed at home than in a factory, though the single woman and the child might with advantage to themselves take work in such establishments. The pay for their labour would contribute, as it ought to do, a reasonable share towards the general support of the family, and the wholesome restraint imposed upon them in the factory, together with an early habit of industry, would contribute to the moral training of young persons; but this is on the supposition that the hours of labour, and the severity of it, were always proportioned to strength and years, and that sufficient leisure were afforded for rest, and for the acquirement of instruction suitable for that station of life into which it has pleased God to call them.

Your correspondent adverts to a general principle in political economy which has been matter of discussion and controversy from the time of Adam Smith; namely, the advantages or the disadvantages that result from foreign trade. It has been in a manner proved that the wealth of a nation is in a greater degree augmented by home consumption, than by any equal amount of traffic with the foreigner; but although it be conceded that this be true, with our overwhelming population, we must either employ it in producing for markets abroad, or submit to see a great portion of our people perish; our acres are not broad enough to furnish food for the whole community, hence we must sell to foreigners some produce or other of the country to obtain wherewithal to purchase food, not to speak of any luxury; and we must sell at low prices, in order to compete successfully in markets abroad. In cotton goods particularly, so much improvement has been made in other countries as seriously to rival our own products, and English profits have sunk accordingly. One firm which, forty-seven years ago, employed above 5,000 operatives, were manufacturing cotton yarn and woven goods at profits of from 15 to 25 per cent.—the same firm were working, twenty-five years later, at a profit of barely 5 per cent.; and since that time, in France particularly, the improvement in cotton fabrics has been immense, and French-made muslin may still be paid more by the yard than an English fabric of equal appearance when new; but the French web is made of a superior quality of cotton than has been used in the English one, so that the French muslin not only wears the longer of the two, but it also continues to look as fine after washing as when new; so French cotton sewing threads work better, and are stronger, than the English ones of equal price, whilst inferior cotton thread is as cheap in France as it is in England. We still maintain our superiority in metal works, but we are now making machinery for Russia which will enable that country at least to rival us in this branch of heavy work, as she long has done at Toula in some of the lighter works in iron. We do, however, produce goods of various kinds at lower prices than the foreigner. It is said that most of the *French* boots sold in London are really made in England, but that the pay to operatives in this, as in many other trades, barely suffices to support existence; so that whether it be better to work even at such low prices, than to leave our starving

people to die of want, is a question that must be answered in the affirmative, whether considered in the light of humanity or as one of political economy. Unless, therefore, it be thought better to throw a great proportion of our operatives out of work than to employ them in making cheap goods for foreign markets, our best policy is to endeavour to manufacture at the lowest possible cost, so that it be not done at the risk of the health, the life, or the morals of the operatives; and this was the object in view in the measure proposed in the *Morning Chronicle*.

The comments of your correspondent, "A. H.," on the article quoted from the *Morning Chronicle*, indicate that the drift of it could not have been clearly understood. It was not referable to the question in political economy as to the effects of doubling *produce*, as seems to have been conceived: for the amount of produce in both the cases instanced was supposed to be the same;—it was, in fact, a mere matter of counting-house calculation. Given a certain quantity of work to be performed, that work requiring the labour for a given number of hours of a given number of operatives—*query*, would it be most economical to employ two sets of those people, one set after the other, in one and the same building, with its appropriate machinery, costing together 20,000*l.*, or to perform the same quantity of work by the same two sets of people at the same time, one set as the other, but necessarily in two separate buildings, with each its appropriate machinery, costing together, in this case, 40,000*l.*? *Answer.*—By performing the whole of the work required in *one* factory, instead of in *two* factories, a saving would be effected of the interest of the money sunk on the second building and its machinery, namely, 20,000*l.*, which, at 8 per cent. on that sum, would produce a money saving of 800*l.* per annum.

It is to be regretted that your able correspondent has not touched upon the subject of a *secondary* employment for factory people. This really is a question affecting each individual of the labouring classes as much as it does the state generally. Sir Samuel Bentham seems to have been the first to have considered this important question in political economy as a science, and as influencing the well-being of the working classes, and the first person who systematically brought the measure into practical operation. Even superficial observers can hardly have failed to notice how frequently the closing of a factory, the letting of a furnace out of blast, the completion of a canal, or of a railroad, throws hundreds of operatives out of work; that these people being habituated to one description of work alone, become burthens to themselves, and to the country as paupers in a union; and that these are unfortunately subjected to the demoralising influence of idleness and bad example. It was in an attempt to do away with these evils on a very limited scale, that Sir Samuel endeavoured privately to rear a few children in two very different employments, and that publicly he demonstrated in actual practice the advantages of this measure. It was in the wood-mills in Portsmouth Dockyard, which, together with the metal-mills and millwright's shop, were under his individual management from the year 1805 for nearly the eight years that followed. They were considered as model establishments, to exemplify the practicability of carrying on Government manufactories as economically as those that are conducted on private account—and he succeeded triumphantly in this respect—but they afforded him besides opportunity of introducing improvements on private practice, amongst which was that of giving to the operatives in the wood-mills two different means of earning a livelihood. In those mills every man, whose general work was the management of a machine, was also trained to and habituated in some manual operation; and every one usually employed in some handicraft was taught to manage a machine. The limited extent of choice did not afford any farther extension of the principle. It was at first supposed that by such an arrangement the advantages resulting from great division of labour would be lost, but in actual practice it proved otherwise; most of the work was paid by the piece, frequently at lower rates than were allowed by private manufacturers to their workmen, yet the earnings of men in those mills were at least equal to, sometimes greatly exceeded, those of other men employed by private persons. The same principle

of giving to all a secondary employment had before been projected on a very extensive scale in naval seminaries; these seminaries were, at his suggestion, intended to have been established in the successive naval administrations of Earls Spencer and St. Vincent, but were opposed by the then Comptroller of the Navy, and lost sight of by Lord Melville. The 4,000 pupils of different ranks intended to have been educated were to have been reared—some for service at sea, either in the military or mercantile marine—others for some of the many businesses carried on in a naval arsenal—but all of them were to be employed for a time on board of Government vessels in home service, though their principal reliance for future support might be a handicraft trade; while those who might take to a life at sea would have been carefully practised in the various arts requisite for the preservation and repair, as well as in the working of a ship; thus every youth so educated would have had two different means of future support, having in ordinary times the choice of either; or when one might fail, he would have had the other to fall back upon. These seminaries would have been self-supporting at that time, and with a trifling modification of the plan might be so still. The deplorable deficiency of education, said now to be so prejudicial in the merchant service, renders it much to be regretted that those intended seminaries were not carried into execution.

Though in a *naval* seminary sea service was the appropriate secondary employ, yet for the great mass of British work people, doubtless, out-of-door labour in the garden or the field would be preferable; it is healthful, and there is always a demand for it, though it be poorly paid for.

The more the question of double entire sets of operatives, working one set after the other in the same factory, is canvassed, the greater seem the advantages of this arrangement to man as well as master. Operatives are becoming reasoning and reasonable beings;—they, doubtless, soon will perceive that their own interest is intimately combined with that of their employers. Ruin of a factory brings ruin on the hundreds dependant on it for daily bread, so that—provided neither man, woman, nor child be worked to excess—any scheme tending to the prosperity of a factory, cannot be otherwise than for both the immediate and the ultimate good of the working hands.

M. S. B.

### STEAM FOR THE ANDES.

An iron steam-boat of small size has recently been built by Mr. George Birkbeck, Jun., of New York, which, from its destination, merits some notice. The boat is 55 feet keel, 12 feet beam, and 5 feet hold. She is to be propelled by two high-pressure engines, of 10-horses power each, connected at right angles. Water wheels 10 feet diameter, and of wrought iron. The whole being fitted together in New York, and each piece marked before being shipped. No piece is to exceed in weight 350 lbs., as, on its arrival at Lima, it has to be transported on the backs of mules to its destination, Lake Titicaca, which is situated near the summit of some of the highest mountains in that country, and several miles above the level of the sea. As yet, commerce must be in its infancy in that elevated region; but the lake is 140 miles long, and its coast well timbered, and it is understood that much traffic would be the result of increased facilities. In case the first boat succeeds, a larger one is to be sent out immediately.—*Journal of the Franklin Institute.*

### SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 11TH, 1850.

WILLIAM JAMIESON, Ashton-under-Lyne, Lancaster, machine maker. *For certain improvements in looms for weaving.* Patent dated October 4, 1849.

The improvements sought to be secured under this patent refer—

1. To a peculiar construction of looms, in which a perforated drum is suspended in the upper part, to which a partial intermittent rotary motion and a rising and falling motion are communicated. The heddles of the loom are attached to levers provided with pins, some of which take into the perforations of the drum, according as the different portions of it come over them, while such of the pins as come in contact with the unperforated parts are depressed, and cause the heddles to be lifted, and the shed formed.

2. To a peculiar mode of stopping the loom when the shuttle misses boxing.

3. To a mode of regulating the taking up of the cloth and delivering the yarn by suspending the rollers by the cloth or yarn

itself, and arranging them in such manner that when they arrive at a certain point they shall rotate, and take up the cloth and deliver the yarn accordingly.

4. To an arrangement of mechanism for actuating the cloth and yarn beams.

William Edward Newton, Chancery-lane, C.E. *For improvements in machinery for planing, tongueing, and grooving boards and planks.* (A communication.) Patent dated October 5, 1849.

The patentee describes and claims an improved planing machine, which consists of a framework, in the lower part whereof are fitted, at the fore end and at about the centre, two carrier wheels, around which passes an endless band composed of metal plates hinged together and fluted on their exterior surfaces. A similar arrangement of wheels and band is placed above the first, and the whole driven by bands and toothed gearing from any prime mover. The plank to be operated upon is introduced between the fluted surfaces of the two bands, and thereby securely held and forced under the planes. The top system of wheels and band is supported in a self-adjustable frame connected by rods to the frame carrying the planing irons. The planes, eight in number, are adjusted at different angles to the plank by means of screws, and in front of each plane is a bar which is made to press upon the plank by means of a spring, and yet yield to any inequalities in its surface. The tongueing and grooving irons are supported in the rear end of the framework on either side of the plank; and the plank is forced between them by the continued movement of the endless bands. Both sides of the plank may be planed at the same time by placing a second set of planes beyond the first with their cutting edges uppermost.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman. *For improvements in the manufacture of pipes or tubes.* (A communication.) Patent dated October 5, 1849.

This invention embraces, 1, a machine to form the sand moulds for the exterior peripheries of pipes; 2, a pipe-core moulding machine; and, 3, a mode of forming core spindles.

1. The pipe peripheral moulding machine consists of two vertical standards, which carry at top a fixed press beam, to the bottom whereof is attached a pattern for compressing sand into the half flask that is supported beneath it, in a carriage suitably hollowed for that purpose. In the lower portions of the standards there are slots which receive the ends of a moveable press beam, and serve to retain it in the same vertical right line during its ascent or descent. This rising and falling motion is communicated to the moveable press beam, by means of two cams placed underneath its ends, which are made to rotate simultaneously by a toothed rack and pinions. The lower part of the flask carriage is furnished with a toothed rack at each end, gearing into two pinions keyed on the same horizontal rod, having a winch handle whereby rotary motion is communicated, and the flask carriage thereby made to travel to and fro between the two press beams. The upper part of the flask carriage has an open hopper extending its whole length, to regulate the quantity of sand admitted to the half flask. At the back of the machine, and extending the whole length of the half flask, is a box, filled with sufficient moulding sand for several flasks, and fitted with a sliding bottom. The top surface of the open hopper above the flask carriage is in the same horizontal plane as that of the sliding bottom, so that when it is pushed under the box, it shall take the place of the bottom, and allow the sand to fall into the half flask, and rise up to the top of the hopper. The motion of the carriage is reversed and brought over the moveable press beam under the pattern fixed to the bottom of the stationary press-beam. The sliding bottom of the sand box is gradually brought under it as the carriage retrogrades, so as to close it and prevent the escape of sand, by means of a catch fastened to the lower part thereof, which takes into a second catch in the side of the flask carriage. A rotary motion is imparted to the cams to lift the moveable beam up, and force the sand up, whereby it will be forcibly compressed in the half flask. When this is effected, the moveable beam is lowered, to allow the racks underneath the carriage to take again into the pinions, the flask to be slidden out and removed, its place taken by an empty one, and the same operation repeated. The half moulds are bound together to form the cylinders for casting.

2. The pipe-core moulding machine consists of a suitable framework, braced together by stays, which contains the core box, divided into four sections by two horizontal planes. The lower section is fixed, and the two side ones are attached to two sliding plates, which are caused to move to and from each other by being connected to two pairs of cranks on a horizontal rod. A partial rotary motion is communicated to this rod by a winch handle according as it is desired that the side sections should recede from or approach each other. The fourth or top section is supported at one side above the other three in the end of a system of jointed levers, or radial arms similar to those used

for raising or lowering the hoods of carriages. The *modus operandi* is as follows:—The side sections are slid out, and the space between them and the fixed section partially filled with sand by an arrangement somewhat similar to that employed in the first machine. The core is then laid upon the sand in the fixed section, and a fresh supply of sand above that. The top section is forced down into position, and the side sections brought together so as to forcibly compress the sand around the core.

3. The core spindle is composed of two strips of metal, intersecting each other at right angles, and having a screw cut upon their edges, round which a wire is wound, upon which the sand is compressed.

*Claims.*—1. The process of forming pipe moulds by compressing a measured quantity of sand into each section of a flask.

2. The process of forming pipe cores by compressing a measured quantity of sand between the converging sections of a core-box.

3. Forming wire spindles, by enveloping a suitable metal rod in wire, upon which the sand is to be compressed.

John Torkington, of Bury, Lancaster, engineer. *For certain improvements in the construction of chairs for railways.* Patent dated October 12, 1849.

The patentee states, that his invention has for its object to obviate more effectually than has yet been done the many serious inconveniences which have been found to arise from the yielding of the rails of railways at the joinings, or points, where the different lengths of the rail meet or cross, during the passage of trains over the same, and consists of certain improvements in the chairs used to support such rails, which improvements are embodied in what he terms, from its peculiar and distinctive features, "The uniformly-supporting Joint Chair." This chair consists of an iron rib or beam, about 3 feet in length, on the upper side of which are three holders, or chairs, cast on, or attached thereto, similar in form to the detached chairs now in use. Two of these holders, or chairs, are situated at the ends, and the third in the centre of the length of the rib, or beam, the upper side of which rib, or beam, forms a support for the ends of the two adjacent rails, which meet at the centre of the middle holder, or chair, and are there held by a key or wedge in the usual manner. Similar keys or wedges are inserted in the two end holders. By this arrangement the bearing of the ends of the rails on the chair, which now seldom exceeds 2 inches, is increased to about 18; and the unyieldingness of the rails under pressure and steadiness of the carriages passing over them are increased in the same proportion. The arrangement is one combining at once all the advantages of the longitudinal system of laying sleepers with those attending the use of transverse sleepers or blocks.

*Claims.*—1. The giving (to the ends of the rails by means of the "uniformly-supporting joint chair," before described) a greater length of bearing on the chairs than has hitherto been done.

2. The distribution by means of the said chair of any pressure coming upon the joints over two sleepers at one and the same time.

3. The securing the ends of two adjacent rails by holders, or chairs, at three or more places, on one rib or beam, as described.

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*Specification Due, but not Enrolled.*

Charles Attwood, Towlaw Iron Works, Darlington, Durham, Esq. *For an improvement in the manufacture of iron.* Patent dated October 5, 1850.

### RECENT AMERICAN PATENTS.

(Selected from the Reports of Mr. Keller, in the *Franklin Journal.*)

For an Improvement in Cast Iron Car Wheels. *Isaac Van Kuran.*

*Claim.*—Casting railroad car wheels with a rim of the form of a semi-elipsis, and of an oblate spheroid near the centre, the hub being cast solid with the same, with braces of the form of cima-reversa and cima-rectas formed in the valley between the rim and oblate spheroidal shell surrounding the hub, arranged in contrary directions on either side.

For an Improved Self-Acting Railroad Switch. *Lucius B. Woods.*

The nature of this invention consists in arranging in front of the switch a transversing lever or bar, moving on a pin at its centre, and attaching to the end of the same a horizontal rod, running parallel with the turnout and main tracks, and connected to vibrating plates moving on pieces at the lower, and having levers connected to the same, and springs arranged on either side, and providing the rods arranged parallel with the main track with a pin or track rising from its upper surface, and passing through an oblique slot formed in an oblong plate secured to the end of a beam attached to the vibrating end of the switch, and through a slot parallel with the track, formed in a stationary oblong plate, in such a manner as to enable the engineer to move the said switch to connect with the track on which the locomotive in desired to run, by simply

moving a lever and causing a horizontal bar to strike the levers attached to the vibrating plates as it passes the same, and move said plates, and the part attached to the same, sufficiently far to produce the desired result.

*Claim.*—The combination and arrangement of the traversing bar or lever, horizontal connecting rods, oblong plates, containing straight and oblique slots, in which the pin or cog rising from the connecting rod next the main track moves; transverse curved bar secured to the oblong plate containing the oblique slot, and to the vibrating ends of the switch; vibrating plates, having cogs from the upper parts, levers and springs, and horizontal bar, on the locomotive, operated as before stated for moving the ends of the switch either next the end of the rails of the main track, or turnout track, at the option of the engineer or other person to whom the duty is assigned.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Walker, of Wednesbury, Stafford, ironmaster, for improvements in the manufacture of sheets or plates of iron for certain purposes. March 28; six months.

James Samuel, of Willoughby House, Middlesex, civil engineer, for certain improvements in the construction of railways and steam engines, and in steam engine machinery. April 5; six months.

Joseph Findlay, of Paisley, Renfrew, North Britain, manufacturer, for an improvement or improvements in machinery or apparatus for turning, cutting, shaping, or reducing wood or other substances. April 5; six months.

George Henry Phipps, of Park-road, Stockwell, Surrey, engineer, for improvements in propelling vessels. April 5; six months.

Jonathan Charles Goodall, of Great College-street, Camden Town, Middlesex, card-maker, for improvements in machinery for cutting paper. April 5; six months.

Charles Seely, of Heighington, Lincoln, merchant, for improvements in grinding wheat and other grain. April 5; six months.

John Platt, of Oldham, Lancaster, engineer, for certain improvements in machinery or apparatus for spinning, doubling, and weaving cotton, flax, and other fibrous substances. April 11; six months.

Richard Prosser, of Birmingham, civil engineer, for certain improvements in machinery and apparatus for manufacturing metal tubes, which improvements in machinery are in part applicable for other purposes where pressure is required; also for improvements in the mode of applying metal tubes in steam boilers, or other vessels requiring metal to be applied within them. April 11; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| April 4 | 2253 | W. H. Martin | Burlington Arcade | The pagetina parasol riding whip. |
| 5 | 2254 | Batters, Clements, and Morton | Saint John's-wharf, Millbank-st. | Wagon-weighing machine. |
| ,, | 2255 | Robert Gordon and Co. | Heaton Foundry, Stockport | Steam-boiler. |
| 8 | 2256 | William Murray | University-street | Self cleansing tubular filter. |
| ,, | 2257 | John Mather | Beaufort-street, Chelsea | Bath valve. |
| ,, | 2258 | A. Beldham and Co. | Portsea | Self-supporting waistband. |
| 9 | 2259 | Joseph Welch and John Margetson | Cheapside | Clarendon cravat. |
| 10 | 2260 | John Gonger | Wood-street, Cheapside | Nonpareil collar. |

## CONTENTS OF THIS NUMBER.



LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London, and 99B, New-street, Birmingham.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1393.] SATURDAY, APRIL 20, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## NIBBS'S OXYDITE CONDENSING LAMP.

Fig. 1.

Fig. 4.

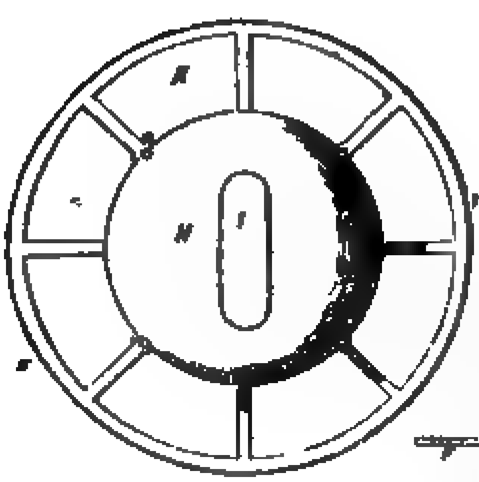
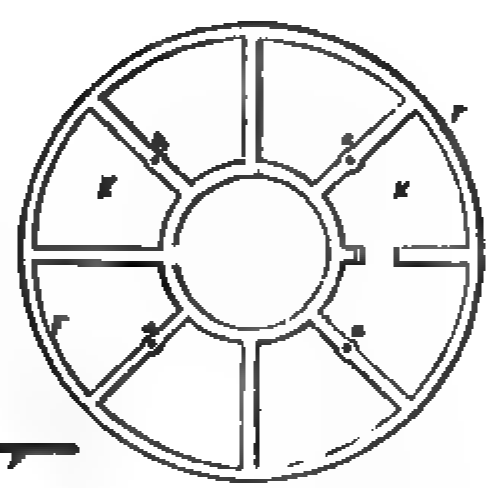


Fig. 5.

Fig. 6.

Fig. 3.



## NIBBS'S OXYDITE CONDENSING LAMP.

(Registered under the Act for the Protection of Articles of Utility. James Tyson Nibbs, of Baslow, Chesterfield, Derbyshire, Proprietor.)

Fig. 1 of the prefixed engravings is a side elevation, partly in section, of this improved lamp. A is an air-tight oil reservoir. B a pipe leading from the bottom of the reservoir A to the "barrel" C, which become partially filled with oil from the reservoir, and into which the cotton or wick D, is placed. E is the wick holder which is dropped into the upper part of the barrel C, and kept in its place by the pin S locking into a slit in the barrel, and resting upon the pipe B, on the opposite side. The wick holder E, is of the form represented in fig. 2, in order to carry a flat wick D, instead of one of the ordinary shape. F is a circular glass holder, which encircles the top part of the barrel C, and carries the glass G, which is prevented from falling off by means of the upright wires *a a*. A plan of the holder is given in fig. 3. H is a "condensing cap," which is fixed to the upper part of the holder E, and made of a circular form at the base, but tapers to an oblong slot or opening, I, in order to allow the flame to pass through, which, owing to the wick being flat, will be of a corresponding shape. The peculiar form of this cap is shown separately in fig. 4, a plan, in fig. 5 a front elevation, and in fig. 6 a side elevation. KK are spaces left in the glass-holder F, to allow of a free current of atmospheric air to press both to that part of the flame inside the cap H, and to that on the outside, as shown by the arrows in fig. 1. L is a "probe" for raising or depressing the wick, a front view of which is given in fig. 7, whereby the flame may be extinguished without causing it to smoke or smell.

By the above arrangement a most brilliant light is produced by burning the commonest of oils, without giving off any smoke or smell.

## THE NEW DOCKS.

The Victoria Docks, now under consideration, have called to mind various old projects for improving the River Thames below bridge, by straightening its course, and some of later date for converting some of its reaches into docks or basins. Engineers have frequently straightened small rivers to improve them, though no one seems yet to have had the courage to bring forward to public notice any similar plan for ameliorating the Thames, except, indeed, that cutting a new bed for the river across the Isle of Dogs was spoken of about the time the canal was made there. The works, which have been since executed, preclude all idea now of effecting that improvement, but it is not yet too late to make a new bed for the stream across the marshy peninsula below Greenwich. The river now takes a very tortuous course around that marsh, forming Blackwall and Bugsby Reaches; were they inclosed as docks they would afford receptacles for an immense number of vessels of great size and depth, and the long lines of double shore would give ample space, not only for the erection of buildings, but also for depositing bulky stores, as timber. As to navigation through the new cut,—besides that it would be but one-fourth of the length through the present reaches, the same wind that serves for Woolwich Reach below, and Greenwich Reach above, would be also favourable for carrying a vessel straight on from one to the other.

By the last of "Weale's Quarterly Papers," it appears that an analogous plan had been formed for improving the river Medway, and that the outline of it had been communicated to the Navy Board in the year 1810. It was designed, besides straightening the course of the river, to form of its present reaches one basin for private trade by Rochester, another for the Naval Arsenal at Chatham, as also a third, which would have been of sufficient extent to contain our whole navy if thought desirable. The estimates for these works indicate that the proposed conversion of Blackwall and Bugsby Reaches into docks, together with making the new bed for the Thames, would not amount to more than the 400,000*l.* estimated for the Victoria Docks independently of buildings.

It may farther be observed, that

straightening the course of the Thames could not but facilitate its carrying off impurities to the sea; therefore the adoption of some such plan as that above indicated seems desirable as a sanitary measure. B.

## ECONOMY OF MANUFACTURES.

Sir,—I perceive, by the remarks of "M. S. B.," that I completely mistook the drift of the paragraph quoted by that intelligent writer from the *Morning Chronicle*. Not having seen anything of the articles in that paper, beyond that extract, I misunderstood its meaning entirely.

The whole subject is one of, literally, such *vital* importance to thousands of our fellow-countrymen, who suffer so much from their own ignorance, or that of their employers, or perhaps of both, as to their real interests, that I cannot refrain from expressing my wish that the *Mechanics' Magazine* had been able, consistently with its character, to devote a portion of its columns to a careful and cautious investigation of this intricate subject; for I do not know of any newspaper, or magazine, or periodical of any kind, which is not too much given up to some party views, to admit perfectly free and unbiassed discussion on these and similar points. I should wish to see the subject investigated with all the calmness and coolness of a purely scientific inquiry. And until some medium for such free and unfettered discussion *is* established, it is almost impossible that any sound and satisfactory knowledge can be gained in the various departments of social and political science; for two very distinct qualifications are necessary in those who wish to learn the truth in these matters. In the first place—an extended and accurate acquaintance with *facts*; secondly, the ability to examine these facts, and draw sound conclusions from them. Now, the first qualification is generally possessed only by practical men—men actually engaged in business—men of long personal experience; but these men are generally deficient in the second qualification. They are almost invariably incapable of taking *comprehensive* views,—they can think only of their own peculiar department, and are neither impartial nor competent judges between themselves and their neighbours. On the other hand, the men who have no personal interest in the matter which they undertake to examine, are generally deficient in the first qualification. They are very superficially acquainted with the facts with which they have to deal. They must rely blindly on the experience of others, and frequently are imposed upon by *ex-parte* statements. As no one man, therefore, can be found who possesses that practical and experimental familiarity with all the great commercial and social interests concerned, which is necessary, on the one hand, and also the impartiality and mental ability necessary on the other, the only way left for discovering the truth, is by bringing these two parties together, or into communication with each other. Social and political science can only be advanced in the same way that astronomy and the physical sciences have been advanced. Facts and observations—carefully made and recorded—must be accumulated, before they can be examined, compared, and arranged under certain general laws. But in what department of social and political science has such a course been ever attempted? We have societies in abundance for observing and recording and speculating on every possible physical fact—from snail shells to central suns—but where is there a society for collecting and examining the myriads of social and political phenomena on which the comfort, and even the lives, of so many millions are dependent? The time will come, when posterity will look back in wonder and amazement at our conduct in these matters. Some future historian of our country will moralize after some such fashion as this, "Our worthy ancestors of the nineteenth and previous centuries seem to have thought (if they thought about the matter at all), that social and political questions were not to be reasoned about like philosophical phenomena, but to be given up to all sorts of curious and random experiments. Whilst they boasted continually of having found out the only rational way of arriving at the laws of nature, and talked very grandly of induction and Baconian methods, &c.; the good people seem never to have dreamt that a similar course might be advisable in other matters. The absurdities and childishness of the early physical inquiries, were now enacted over again in the

social and political arena. All sorts of mad theories and wild systems were rife. Each had a theory—each had a doctrine. One man preached up free trade in corn as a panacea; another had a currency nostrum; a third had a nice new poor-law; a fourth said nothing would do but everybody must take themselves and their families off, post haste, to the antipodes, or the North Pole—anywhere out of the way; a fifth asserted that everything and everybody must be *protected* against everything and everybody else, or else everything and everybody would mutually destroy each other, from the nature of things; a sixth thought everybody and everything ought to be *represented;* a seventh thought we ought to have no dealings with the French or Yankees, but everybody deal with himself, thereby replacing his own capital with a profit, and affording encouragement to his own industry: and so on *ad infinitum.* Each of these gentlemen got a little circle of adherents round him, and each of these circles abused and pooh-poohed all the other circles, and wouldn't listen to them for an instant on any account. And each of these sent somebody to 'represent' them and their crotchet in *the* House; and when one of these worthies ventured humbly to bring forward *his* motion, forthwith all the others turned up their noses, and turned their backs upon it, and threw cold water on it, and voted against it. And so it came to pass, when they saw that nothing at all was done in this way of going on, or *not* going on, they hit upon a new scheme; and No. 1 agreed to vote for the nostrum of No. 2, on condition of receiving a similar favour in return; each regarding the other as a humbug, nevertheless. And so some nostrums got tried and others didn't. And then if things *chanced* to go right, after one of these nostrums was carried, its proposer crowed over all the rest, and said he '*knew* it would be so, and always foresaw that it must be so, and what a set of stupid fools they must be not to see it too.' But all this while, no one ever thought of inquiring how much truth there might be in the opinions of No. 1, how much in those of No. 2, and so on; and then putting together these scattered portions of truth, leaving the errors to correct each other; and lastly, acting on the combined information thus obtained." But enough of this "Future History of the Past," which will certainly, however, be one day written.

Social and political economy can only become a science by the united efforts of practical and speculative men; the one to furnish facts, the other to reason upon them. If a society were formed of such men, the narrow views and partial considerations of one class would be widened and corrected by the more general views of the other, who, in turn, would have their rash generalizations and premature theories controlled by the practical experience of the business man. Until such societies are formed, we shall continue to see individual energies *wasted*—an eternal succession of pet theories, put forward, only to be ridiculed and scouted by those who can detect the slightest flaw in them, without ever getting so much as a fair hearing, or credit for what little truth they may contain. To expect that every one joining such a society should be *disinterested,* would be to expect a different order of beings to ordinary mortals. But it is to the very principle of self-interest that I would appeal, when I invite all parties to join in such an inquiry; for it must have become obvious to every man of any sense, that *class-interests* can no longer be maintained against the growing spirit of inquiry in *other* classes; and any unjust or unreasonable advantages in any class are sure to be swept away, and after a great deal of bad feeling, concessions will have to be made, which had much better be granted in a friendly spirit to begin with. The safest policy in the long run, and the truest self-interest is, to submit to examination, and to give up all attempts at concealing the truth, which can only serve the purpose for a short time, and when discovered, are sure to bring down tenfold retribution. Honest, and honourable, and generous feeling, depend on it, is the only safe defence of any class of the community at the present day.

But, to return to the more immediate subject before me. I fully agree with "M. S. B.," that the employment of children in factories is by no means to be discouraged, *provided* the amount of work required of them be not greater than is consistent with their health and education. But, on no account or pretence whatever, should *married women* be employed in factories. Every married woman has, or ought to have, quite enough to do at home.

As to "secondary" occupations for a manufacturing population, I have not thought on the subject sufficiently to warrant my entering on any discussion of it. This much, however, certainly appears evident; that the "division of employment" so highly, and indeed so justly, extolled by all political economists, as a means of increasing *national* wealth may, nevertheless, be carried so far as to produce very great evils in several ways. For instance, every fresh improvement in machinery, by rendering fewer hands necessary in that particular branch of manufacture (at least *for a time*) throws several persons out of employment, who must seek their living in some other branch of trade (at least *for a time*). But, generally speaking, they are only acquainted with one branch of manufactures, and are, consequently, incapable of turning their hands to a new business. Whether it would be practicable to instruct all operatives in *two* (or more) branches of industry—so that one failing they might fall back on the other, without impairing their skill and dexterity in each, to a greater extent than the benefit obtained—is a question I cannot answer, but it is well worth trying. If found to answer on *a grand scale* and *as a general system*, as well as in Sir Samuel Bentham's limited experiment, it would, indeed, be a great blessing to the manufacturing classes.

The other point to which "M. S. B." has alluded; namely, "foreign trade," is confessedly a difficult and intricate one, when considered *in all its bearings*. My remarks were offered merely as conjectures. We cannot be too cautious in making or receiving statements on this subject, and still more caution is needed in speculating on such statements I have some hesitation in acceding to the assumption of "M. S. B.," that "our acres are not broad enough to furnish food to the whole community." Whether it be, on the whole, advisable that we should attempt to be independent of foreign supplies of corn, or not, is another question. But I think it highly probable that England might be made to support not only its present population, but one twice as numerous, or even more so. It is the opinion of sober and competent judges that, even with our present system of large farms, the agricultural produce of this country might be *doubled* by improved methods of cultivation. (See "Johnston's Lectures on Agricultural Chemistry.") And then if you once break up the large farms into peasant-holdings, looking at the results of such a step on the Continent, the increase of production is almost incalculable. But, as I said before, whether it is not our wiser policy to buy our corn of other nations, and to devote a certain portion of our population to manufactures, &c., to pay for this corn is a very difficult question.

On the subject of competition, &c., as lowering the price of our manufactured goods, I would ask the following question:

How far is the cheapening of our manufactures owing to the following causes respectively?

1. To competition of our own manufacturers against *each other*.
2. To competition of British against foreign manufactures.
3. To improvements in machinery.
4. To lowering of wages.

On the answers to these questions it will depend how far my conjectures are well founded as to the *needless* drudgery of John Bull.

For the present I must conclude.

Yours, &c.,

A. H.

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ANALYSIS OF THE EVIDENCE GIVEN BY THE WITNESSES EXAMINED BY THE COMMISSIONERS APPOINTED TO INQUIRE INTO THE APPLICATION OF IRON TO RAILWAY STRUCTURES.

*John Urpath Rastrick, Esq.*, civil engineer.—6. Has experimented on Staffordshire and Shropshire iron.—7. Prefers forge iron for large castings.—8, 9. With pure mine hot-blast iron is equal in strength to cold-blast, but the hot blast enables cinder to be used, which deteriorates the quality. —10, 11. The temperature of the blast alters the quantity but not the quality of the metal produced, about 500 or 600 degrees is preferred.—14. The only guarantee against bad iron is to contract for a particular quality.—15. There is no mode of detecting the difference between two kinds of iron.—16. A mixture of the Penistone ore from Shropshire with the Staffordshire ironstones improves the quality of iron.—17. For strong castings a mixture of pig iron is preferable to mixing the ores; a good mixture is formed from

Low Moor iron, Old Park iron, and Colebrooke Dale iron.—20. Cast the bridge at Chepstow.—22, 23. Allows a ton, as the breaking weight of a bar, 1 inch square and 1 foot between the bearings.—25. Proves a beam to 1-3rd of the breaking weight, but never trusts it to carry more than 1-6th.—26, 35. Iron girders may be cast of almost any length, provided they have strength in proportion; made beams for the British Museum 41 feet long, in 1824 or 1825, they had open work in the web, and were 3 feet or 3 feet 6 inches deep, they were proved by laying on 15 or 20 tons of actual weight, and struck with a heavy hammer of 14 or 20 lbs. weight.—36. In simple girders, if the height is too confined, the strength required must be given by thickness.—40. A girder will bear the same weight on the bottom flange as on the top.—41, 42. The torsion caused by placing the weight on the bottom flange is very trifling, and cannot take place without a greater amount of deflection in the bearer than should be allowed.—43, 44. Puts on brackets to unite the flange to the girder.—45. The strength of the joists supporting the roadway should be sufficient to prevent them pushing out the flanges.—48. A flange never breaks off.—49. As long as a weight on a girder is not sufficient to injure the elasticity no matter how long it remains.—50. A beam taken out of a mould while hot will break by its own weight.—51. Cast iron is more fragile in winter than in summer.—52. In the Chepstow Bridge of 112 feet span, versed sine 3 feet, the difference of temperature between summer and winter altered the position of the crown of the arch by 2 inches. 58-62. Bridges requiring a flat soffit are best supported by a bow above the roadway. —63-67. No combination of wrought or cast iron is equal to a solid casting, the two metals hamper each other.—68. An arch is the best form for a bridge of cast iron.—70. Vibration and impact will not injure the joints and rivets of compound girders if they are strong enough.—72. Railway girders should be so strong that the deflection should be immaterial.—75-79. At the Pontypool Iron Works a bar of wrought iron 1 inch square was hung up by one end, and struck at the bottom by a small hammer continually for twelve months until the bar dropped in two.—80, 81. The vibration upon a railway bridge is too small to affect it.—Doubts whether the fractures of railway axles can be attributed to vibration.—83. If in a railway bridge no permanent deflection has taken place after it has been in use for twelve or eighteen months, considers that it has not been affected by the running of the train.—84, 85. Has not observed that fish-bellied rails break from becoming crystallized.—86. In proving a girder allows a deflection of 1-500th of the length.—88. Considers a rapidly-passing weight will cause less deflection than a stationary weight.—99. Prefers cast iron in all cases to wrought iron. —98. In a span of 100 to 200 feet an arch is best; if the height does not admit of it, under the roadway it should be placed above. —99. The difficulty of transport is the only limit to the length of castings.

*John Hawkshaw, Esq.*, civil engineer.—106, 107. Lowmoor iron is the best for girder bridges, good grey Staffordshire the next best.—112, 113, 1-3rd of No. 1 and 2-3rds of No. 2 of the best Staffordshire or South Wales iron is a good mixture for large castings.—114. Hot-blast iron is not so strong as cold-blast iron.—117. The only guarantee against the use of hot-blast iron is the character of the founder.—119. The strength of a girder should be seven times the load, and would test it to at least double the load.—122. The spans for simple cast-iron girders might be increased beyond those in use.—124. Would not hesitate to make a simple cast-iron girder of 100 feet span.—127. In designing a simple cast-iron girder obtains the form for the requisite strength by Mr. Hodgkinson's formula, and trebles the area of the top flange to get lateral stability, thus making the top flange half the area of the bottom.—129. In testing beams it is desirable to give vibration by blows while the pressure is on, or if actual weight is applied, to throw the weights into the scale.—132. A girder cannot bear so much weight on one of the bottom flanges as if applied at top.—133. The weight so applied produces a torsion.—134. By increasing the top flange and adding brackets, the torsion is diminished.—136. It would be nearer a practical result to test a beam in the way in which the weight will be applied.—142. The objection to contrivances for throwing the weight in the centre plane of the girder is that by departing from the simple form the liability to unsoundness in the casting is increased.—149. It is possible that weak girders loaded with a permanent weight might increase in deflection after a length of time.—150. The deflection of a girder should be almost imperceptible.—152. The Knottingly Canal Bridge of 89 feet span deflected half an inch with an engine of 22 tons going at 50 miles per hour, the bridge is too weak. —159. Prefers not using compound girders, it is, however, possible to make them strong and safe.—160. Prefers plain girders with the top flange increased to prevent lateral twisting.—162. It would be useful to ascertain the strength of beams

under loads applied as in practice.—163. For spans of 100 or 200 feet, which must be crossed with a level soffit, a truss like that for a roof is preferable, or a bow-string bridge.—166. Joints and rivets will not suffer from vibration if made originally strong.—168. Where there is impact or vibration there should be large surplus strength, a breaking strength of seven times the load.—170. Has seen numberless cases of broken axles and broken rails when frequently crystallization existed, but cannot say whether it is attributable to a succession of blows.—171. Experiments on the subject are desirable.—174. Mill-gearing affords examples already made; the cast iron is there subjected to blows and vibration, and the machinery goes on running for years.—175. The use of cast iron in mill-gearing gives confidence in its application to other purposes; by inquiring into the wear and tear of mill-gearing the length of time that iron will bear shocks might be ascertained.—177. The irregularity in the surface of the rails would cause a weight moving with velocity to deflect a beam more than a similar stationary weight.—178. No practical velocity would be such as not to give time for deflection.—180. Ice does not afford a parallel case; ice has a better surface, and time must be allowed for the displacement of water.—181. Is erecting two bridges with wrought-iron tubular girders.—182. Wrought iron gives more warning than cast iron.—184. The load on railway bridges may be taken at 1¾ tons per linear foot.—185. The heaviest load is a locomotive engine; there is a rule on all railways prohibiting trucks being loaded beyond a certain point.—186. Locomotives weigh about 22 tons, and the tenders 10 or 12 tons.—191. The weight on a bridge covered with locomotive engines, including the roadway, would be 2 tons per linear foot.—193. It is desirable to ascertain the real facts with regard to the trustworthiness of cast iron.—194. The conditions under which cast iron is placed in railway structures is similar to that in mill-gearing, and the quantity of cast-iron shafting and length of time it has been in use might be ascertained.—196. Is making a wrought-iron bridge of 100 feet span; it appears easier to construct one of that span of malleable than of cast iron.—197. The cost determined the adoption of wrought iron; objects to the combination of wrought and cast iron except in bow-string bridges.—198. The wrought iron girders are made double, to obtain lateral stiffness.—202. Without reference to expense, an arch is the best form for cast iron.—203. The level soffit is adopted from necessity.—204. For the strength of the wrought iron girders, Mr. Hodgkinson's formula for cast iron was used, adopting 70 as coefficient instead of 28, and taking care to make the upper flange strong enough; has not had enough to do with that form of girder to be certain of the precise proportions.

*Charles Fox, Esq.*, Civil Engineer.—223. The mixtures to be preferred for particular works depend upon the locality, as the cost must be considered; would use in the Midland Counties iron from Staffordshire and Shropshire, on the sea cost Welch and Scotch.—224. 2-3rds Blaenavon (cold-blast Welch), and 1-3rd of Scotch in equal proportions from the Blackband and from the Red Hematite, is a very good mixture.—230. Is convinced that metal made by the hot-blast would be as good as from cold blast if the mine were properly treated; but the custom in Scotland has been to care for quantity not for quality.—231-233. The only guarantee against inferior metal is to contract that girders shall not break with less than a specified weight, and to cast one more than is required, and select any one for trial, and if it fails reject the whole.—234. In girders not subjected to vibration, considers that the greatest load should not exceed 1-3rd of the breaking weight; in girders for railway bridges, 1-4th.—236. Proves girders to double the greatest load.—240. For girders of new forms applies the proof by dead weight; but in known forms, uses the hydraulic press as being more convenient, observing the amount of deflection.—242. Considers the objection to the hydraulic press obviated by the use of cylindrical instead of conical valves.—243. The load on one of the bottom flanges is not objectionable, provided the girder does not cant.—244. Tests girders sometimes by a weight applied to one of the bottom flanges.—249. Considers a span of about 50 feet as the limit for simple cast-iron girders.—250. For girders to support a quiescent load would make the section of the top flange 1-6th that of the bottom.—253. In a railway bridge, where the top table would not be supported laterally, would make the area of the top table 1-4th that of the bottom.—255. In a railway bridge where the top table is supported laterally, makes the area of the top flange 1-5th that of the bottom.—257. The top flange of a girder being subject to compression may be compared to a column; and if bent its liability to break will be increased.—260. If circumstances required, would make a girder of more than 60 feet long in one piece; roving bridges over the New Birmingham Canal are 80 feet long, cast in one piece.—261. In well-constructed bridges the de-

flection of the platform should not cause any injury.—262. Considers the smallest weight applied impairs the elasticity of a beam, and that a girder exposed to change of temperature and vibration will swag, and that this effect will go on increasing; but he considers that the only diminution of strength from this is due to the diminution of the sectional area of the bottom table; but that in cases where a beam is not subject to change of temperature, it would retain its original position.—264. Instances some girders 6 feet long for supporting hoods to smiths' forges, which are warmed by day and allowed to cool at night; they sway nearly 3 inches in the centre.—265. Considers that in the alteration in the arrangement of the particles of iron caused by a change of temperature the weight takes advantage of the change.—266. Does not consider that removing and replacing a weight on a beam continually would have quite the same effect; mentions that anchors when tested take a week to regain their original position; considers alterations of temperature more likely to produce swagging than vibration.—267-273. Thinks that railway girders will gradually swag and must be exchanged, and that few which have been 10 years in use have not swagged, but that their strength is only impaired to the extent mentioned above; the greater the inertia of the bridge the longer would the action be delayed.—274. Considers the mode of supporting the roadway on one side of the girder to be wrong.—275. The deflection of a girder should not be considered with reference to the span.—279. For large spans, prefers cast iron on the principle of compression. — 280-282. Would make straight girders for large spans of several castings bolted together with wrought iron tension rods fixed horizontally along the bottom flange, and put considerable initial strain upon the wrought iron bars, that the cast iron may come into operation when the wrought iron is under a considerable degree of tension, so that the ultimate effect from the two may be obtained.—283, 284. The expansion produced by changes of temperature being only a differential quantity, would be small in a length of 100 feet; and the wrought iron being more elastic than cast iron, should bear it.—288. The bowstring girder, with a bow of cast and a string of wrought iron, would be cheap and safe.—290-292. A bridge for crossing the Arno is being made of straight girders on the abovementioned principle; the wrought-iron bars are under a tensile power of six tons per square inch.—293-295. In process of time the wrought iron would stretch 1-16th inch in 10 feet, with a weight of 10 tons.—296. Would not let rails rest on the top of a wrought iron riveted girder without a piece of wood between.—297. Girders made of separate castings should, in addition to bolts, have a wrought-iron tie-bar.—300. Soft timber between the rails and girders will prevent danger from vibration.—303. Considers alteration of temperature as likely to subject wrought iron girders to a great deal of undue compression and extension.—306. Thinks experiments on impact and vibration desirable.—308-318. Believes that wrought iron is rendered crystalline by a succession of slight blows at a low temperature, and has observed that the older axles are the more crystalline they are; also remarks, that if the thread of a screw be cut on a bar of fibrous iron, the tapped part will break with a more crystalline fracture than the other. Shafts in mill-work break and exhibit a crystalline structure.—319-323. Thinks cold hammering injurious to axles from tending to make them crystalline, and also from producing a strain like that produced by straightening castings by hammering. Would prefer their being finished at a high temperature to being annealed. Cold hammered axles may be detected by their appearance.—324. Thinks experiments on long-continued deflection are very desirable. —326. In estimating the strength of a girder, adopts as the greatest weight 1½ tons per foot per single line of way; that is, half a ton per foot for weight of platform and 1 ton per foot for weight of train; for two girders of 40 feet span, would take the weight at 60 tons distributed, equal to 30 tons in the centre. Would calculate the breaking weight of each girder at 60 tons in the centre, and prove them to 30 tons.—328-331. Considers that with a carefully-laid road the deflection due to rapidly-moving weights is less than that due to such weights at rest, from the shorter time allowed to overcome the *vis inertiæ* of the bridge.—332-333. Thinks there has been a great want of fixed principles in the construction of railway bridges; no general principle has been laid down; whilst one engineer is satisfied with one amount of proof, another adopts six times as much.—334. In making contracts for railway chairs, stipulates that the mixture he uses when cast into a bar of a certain form shall break with a specified weight.—338. Is inclined to think the castings from the air-furnaces better than those from the cupola, but the difference is very minute.

*Henry Grissell, Esq.*, Iron-founder and machinist. — 342. Amongst other large works, is at present constructing a built girder bridge for a span of 121 feet; it is 12 feet high, and weighs 100 tons; it has been proved to 108 tons distributed over it.

pensive.—392. Would guarantee a straight girder with top and bottom flange to bear —348. Has not studied the chemical constitution of iron.—349. Prefers a mixture of iron for castings.—350. The mixture depends on the state of the markets; and from old iron being so plentiful in London, pig-iron is not considered so much as in the country.—351. Mixes Scotch iron, old iron, cold-blast Welch iron, the proportions being dependent on the appearance of the fractures; for cylinders a larger proportion of cold-blast iron is used than for girders.—355. Considers London castings 15 per cent. stronger than country ones, from the use of old iron.—356. Hot-blast iron when mixed is as good as cold-blast, but alone it is not to be depended on.—357. The proportions for mixtures are so dependent on the qualities of iron, that he is guided by the appearance of the fractures in determining them. —358. Considers he could mix iron so as to make a casting bear any weight in reason. —359. Could not tell hot-blast from cold-blast iron from the fracture.—360. The proportion of stress to strength varies with the section of the girder and the strains to which it is subjected; generally considers the load should be 1-3rd the breaking weight for railway bridges.—363. Handed in the rule he adopts in calculating the strength of girders.—364. Has made simple and compound girders.—365. Would make a girder in one casting 50 or 60 feet.—367. Considers a level top flange a waste of metal.—368. In designing a girder, judges by the eye of the probable strains it would be subject to, and then calculates the strength, and alters the form so as to obtain the greatest strength with the least quantity of metal. —369. Adopts the double T section, the bottom flange being largest. 370. Girders may be proved by a lever or an hydraulic press; the latter is what he usually adopts, and it is as certain as the lever when correctly made.—372. Does not think a girder will bear the same weight if applied only on one flange as if applied to both equally.—373. Proves girders to find out whether the castings is sound, and so applies the proof to the top.—374. Has never noticed that length of time or change of temperature makes beams swag.—377. For compound girders prefers the built girder.—385. Considers half an inch deflection may be allowed in every 20 feet of length; can regulate the deflection by the mixture of iron he uses; would not consider a beam injured by a deflection of three-fourths of an inch in 20 feet, if it returned to its original position.—387. For large spans when not tied by expense or height, would generally prefer a built girder. —390. But thinks that an arch is a stronger form than a straight girder, but more expensive any amount of pressure.—393. Would not hesitate to use one for a span of 200 feet; thinks it would bear any weight that could come on.—394. Does not think impact and vibration would affect large bolts and rivets, but that where no more than just the necessary strength is put in, every jar would tend to loosen them.—396. Thinks vibration dangerous to wrought iron; vibration takes much more effect on wrought iron than on cast iron.—397. Has observed in crane chains an alteration in the structure of the iron, after a few years' use; instead of its breaking with a black tensile appearance, it breaks short and white like cast iron; it is changed from beautiful malleable iron to the appearance of very good cast iron.—402. Cold hammering will also produce this effect on cast iron, but it can be restored very nearly to its original texture by annealing.—404. Feels convinced wrought-iron girders will become altered to a crystalline texture by vibration.—405. Knows no case of cast iron becoming altered, or breaking from vibration alone.—411. Has not given his attention to axles.—412. Has made numerous experiments on iron of all sorts and mixtures.—418. Considers that if the form of a girder be given, he could mix the iron for making it to such a degree of nicety, that he could guarantee any amount of deflection, and carry any load required in moderation. Attaches the greatest value to old iron, but not to differences in pig iron; considers all Scotch iron to be much of the same quality, except one or two sorts, which are very superior.—419. The metal for mixtures must be selected with great judgment.—421. Does not consider it necessary to try the relative strengths of the different sorts of metal before mixing, but judges of the proportions by the fracture.—422. A good mixture would be 1-3rd. hot-blast iron, 1-3rd. old iron, and 1-3rd. Blaenavon Welch iron, but he does not confine himself to one particular mixture.

(*To be continued.*)

### LORKIN'S PATENT EGG-BEATER.

(See *ante*, p. 238.)

The specification of this valuable addition to domestic furniture describes numerous forms in which it may be constructed, but all possessing this common feature—that they enable the user to effect the trituration or beating-up of the egg (or other viscous or gelatinous substance) in incomparably less time than the same operation can be performed by hand in the usual way—that is, with a fork or whisk, in an open and plain-surfaced ves-

sel. The form first described, and which will probably be found the most suitable for general use (in private families, at least), is represented in the subjoined engravings. Fig. 1 is an external elevation of the instrument; fig. 2 is a sectional elevation of it, with the lid removed; fig. 3 a plan; and fig. 4 a separate plan of the lid.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

A A is a cylindrical vessel, formed of wood, earthenware, metal, or other suitable material, to the inner surface of which there are affixed three rows of projecting pins or beaters B, B, B, five in each row, which are so placed in relation to one another, that those of each row come opposite to the intermediate spaces between the beaters of the opposite row. C is the lid, which has two projections D D, which take into a groove E E formed in the lip of the vessel. When the lid is put on, the projections D D are inserted into the openings *e e*, through which they gain admission into the groove E E, whereupon, by turning the lid a little round, it becomes securely and closely fixed in its place. The portions of the egg or other substance to be "beat up" being put into the vessel A A, and the lid put on as above described, the vessel is then taken in the hand, and shaken to and fro with such a degree of force, as to cause the contents to be driven successively against the top and bottom and sides of the vessel, during which operation the beaters B B break up and comminute the materials, and cause them to assume the triturated and frothy state desired.

In one of the other varieties described, the cylindrical vessel is fitted inside with two diaphragms of wire gauze, the wires of which produce the same breaking up or triturating action as is effected by the projecting pins or beaters.

Another form of beater is given, stated to be "specially suited for breaking up large quantities at a time," in which a

rotary motion is substituted for the reciprocating action of the other instruments. In this modification the beaters are attached to a spindle, to which a rotary motion is given by a crank handle, and sometimes the speed is multiplied by the addition of wheel gearing.

*Claim.*—I do not restrict myself to the number, size, position, or order of arrangement of the beaters employed in the said instrument or apparatus, or to making the same wholely or partially of any particular material or materials, or to any specific means of giving a reciprocating or rotary or whirling motion to the same, but that what I claim is the beating or triturating of viscuous or gelatinous substances by means of an instrument or apparatus consisting of a cylinder (or other suitable vessel) containing in the inside thereof projecting beaters or interstícial diaphragms as before described.

### RIVER NAVIGATION IN THE UNITED STATES.

(From "Dr. Lardner's Railway Economy.")

The river navigation of the United States is on a scale commensurate with the extent of their territory. The division of the country east of the Alleghanies, forming the Atlantic States, is drained by a vast number of rivers, of the first and second class, all navigable for vessels of considerable burthen, the principal of which are the Hudson, the Delaware, the Susquehanna, the Connecticut, the Potomac, the James, the Roanoke, the Savannah, and, to the southwards, the Atamala and the Alabama.

The western division is drained by the Mississippi and its hundred tributaries, navigable for vessels of great tonnage for several thousands of miles.

Besides the internal communication supplied by rivers, properly so called, a vast apparatus of water transport is derived from the geographical character of the extensive coast, stretching for about four thousand miles, from the Gulf of St. Lawrence to the delta of the Mississippi, indented and serrated in every part with natural harbours and sheltered bays, fringed with islands, forming sounds, throwing out capes and promontories, which inclose arms of the sea, in which the waters are free from the roll of the ocean, and which, for all the purposes of internal navigation, have the character of rivers and lakes. The lines of communication, formed by the vast and numerous rivers, are completed in the interior by chains of lakes, presenting the most extensive bodies of fresh water in the known world.

Whatever may be the dispute maintained among the historians of art as to the conflicting claims for the invention of steam navigation, it is an incontestible fact that the first steam-boat practically exhibited for any useful purpose, was placed on the Hudson, to ply between New York and Albany, in the beginning of the year 1808. From that time to the present, this river has been the theatre of the most remarkable series of experiments on locomotion on water ever recorded in the history of man.

The Hudson rises near Lake Champlain, the easternmost of the great chain of lakes or inland seas which extend from east to west across the northern boundary of the United States. The river follows nearly a straight course southwards for 250 miles, and empties itself into the sea at New York. The influence of the tide is felt as far as Albany, above which the stream begins to contract. Although this river, in magnitude and extent, is by no means equal to several others which intersect the States, it is nevertheless rendered an object of great interest by reason of the importance and extent of its trade. The produce of the State of New York, and that of the banks of the lakes Ontario and Erie, are transported by it to the city; and one of the most extensive and populous districts of the United States is supplied with the necessary imports by its waters. A large fleet of vessels is constantly engaged in its navigation; nor is the tardy but picturesque sailing vessel as yet excluded by the more rapid steamer. The current of the Hudson is said to average nearly three miles an hour; but as the ebb and flow of the tide are felt as far as Albany, the passage of the steamers between that place and New York may be regarded as equally affected by currents in both directions. The passage, therefore, whether in ascending or descending the river, is made in the same time.

This river is navigable by steamers of a large class as far as Albany, nearly 150 miles above New York.

Attempts have been made, but hitherto without much success, to push the navigation a few miles higher, as far as the important town of Troy. The impediments arising, however, from the shallowness of the river appear to be so serious, that Albany has continued, and probably will continue, to be the limit of steam navigation in this direction.

The steam navigation of the Hudson is entitled to attention, not only because of the immense traffic of which it is the vehicle, but because it forms a sort of model for

most of the rivers of the Atlantic states. This navigation is conducted, as will be seen, in a manner and on a principle altogether different from that which prevails on the Mississippi and its tributaries.

In the steam-vessels used on these rivers, no other strength or stability is required than is sufficient to enable them to float and bear a progressive motion through the water. Not having to encounter the agitated surface of an open sea, they are supplied with neither rigging nor sails, and are built exclusively with a view to speed. Compared with sea-going steamers, they are slender and weak in their structure, with great length in proportion to their beam, and a very small draught of water.

The position and form of the machinery are affected by these circumstances. Without the necessity of being protected from a rough sea, the engines are placed on the deck in a comparatively elevated situation. The cylinders of large diameter and short stroke, almost invariably used in sea-going ships, are rejected in these river boats, and the proportions are reversed,—a comparatively small diameter and a stroke of great length being adopted. It is but rarely that two engines are used. A single engine, placed in the centre of the deck, drives a crank placed on the axle of the enormous paddle-wheels. The great magnitude of these latter, and the velocity imparted to them, enable them to perform the office of fly-wheels, and to carry the engine through its dead points with but little perceptible inequality of motion. The length of stroke adopted in these engines supplies the means of using the expansive principle with great effect.

The steamers which navigate the Hudson are vessels of great magnitude, splendidly fitted up for the accommodation of passengers; and this magnitude and splendour of accommodation have been continually augmented from year to year to the present time.

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Within the last ten years considerable changes have been made in the proportion and dimensions of the vessels navigating this river; all these changes having a tendency to augment their magnitude and power, to diminish their draft of water, and to increase the play of the expansive principle. Increased length and beam have been resorted to with great success. Vessels of the largest class now draw only as much water as the smallest drew a few years ago: 4 ft. 6 in. is now regarded as the maximum.

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It is not only in dimensions that these vessels have undergone improvements. The exhibition of the beautifully finished machinery of the English Atlantic steamers did not fail to excite the emulation of the American engineers and steam-boat proprietors, who ceased to be content with the comparatively rude though efficient structure of the mechanism of their steam-boats. All the vessels more recently constructed are accordingly finished, and even decorated, in the most luxurious manner. In respect of the accommodations which they afford to passengers, no water communication in any country in the world can compare with them. Nothing can exceed the splendour and luxury of the furniture. Silk, velvet, and the most expensive carpeting, mirrors of immense magnitude, gilding and carving, are used profusely in their decorations. Even the engine-room in some of them is lined with mirrors. In the *Alida*, for example, the end of the room containing the machinery is composed of one large mirror, in which the movements of the highly-finished machinery are reflected.

All the new and largest class of steamers, such as the *Isaac Newton*, the *Hendrik Hudson*, the *New World*, the *Oregon*, and the *Alida*, are capable of running from 20 to 22 miles an hour, and make, on an average, 18 miles an hour without the least effort. These extraordinary speeds are obtained usually by rendering the boilers capable of carrying steam from 40 to 50 lbs. pressure above the atmosphere, and by urging the fires with fanners, worked by an independent engine, by which the furnaces can be forced to any desired extent.

It is right to observe here, that this extreme increase of speed is obtained at a disproportionately increased consumption of fuel. When the speed is increased, the space through which the vessel must be propelled per minute is increased in the same proportion: and, at the same time, the resistance which the moving power has to overcome is augmented in the proportion of the square of the speed. Hence, the effect to be produced by the moving power per minute, is increased by two causes: first, the actual resistance which it has to overcome is augmented in the ratio of the square of the speed; and, secondly, the space through which the moving power has to act against this resistance in each minute is increased in the ratio of the speed. Thus, the total expenditure of moving power per minute will be augmented in the proportion of the cube of the speed.

Let us suppose the speed to be increased, for example, from 18 to 21 miles an hour: the power to be expended per minute to produce this effect must be increased in the ratio of the cube of 18 to the cube of 21,

or, what is the same, in the ratio of the cube of 6 to the cube of 7; that is, in the ratio of 216 to 348, or as 3 to 5 very nearly.

Hence, if the furnaces could be worked with equal economy, an increased consumption of fuel per hour would be necessary in the proportion of 3 to 5; but the waste incurred by urging the blowers so as to produce a sufficiently vivid combustion is so great, that it is practically found that the consumption of fuel is increased in a much higher ratio than that which results from the increased resistance; and, indeed, in some cases that the increase of three or four miles an hour on 18 miles will cause nearly triple the consumption of fuel.

Much of the efficiency of these engines arises from the application of the expansive principle; but to this there has been hitherto a limit, owing to the inequality of the action of the piston when urged by expanding steam on the crank. When the steam is cut off at less than half-stroke, the force of the piston is diminished before the termination of the stroke to less than one-half its original amount. This inequality is aggravated by the relative position of the crank and connecting-rod, the leverage diminishing in nearly the same proportion as the power of the piston diminishes. On this account it has not been found generally practicable to cut off the steam at less than half-stroke.

A recent improvement, invented by Captain Ericsson, is directed to remove this defect. The steam is worked successively in two cylinders of different magnitudes, as in the engines of Woolf and Hornblower, but without allowing the action of the first piston to impair the effect of the second; and the arrangement of the connection between the piston and the crank-shaft is such, that, notwithstanding the expansion of the steam to from 20 to 30 times its original volume, the action on the crank is more uniform than in the common crank engine, even when worked without expansion.

The effect of this arrangement is reported to be a saving in the consumption of fuel of very large amount. A small trial-engine of ten-horses power is stated to have been worked by the consumption of 15 lbs. of coal per hour, being at the rate of 1½ lb. per horse per hour.

It must be observed, in relation to the navigation of these eastern rivers, that the occurrence of explosions is almost unheard of. During the last ten years, not a single catastrophe of that kind has occurred on them, although cylindrical boilers 10 feet in diameter, and composed of plating five-sixteenth's of an inch thick, are commonly used with steam of 50 lbs. pressure above the atmosphere.

It will be seen by the Table given above that the paddle-wheels used on these rivers have extraordinary magnitude. There is nothing particular in their construction. The split paddle-board, which was adopted about ten years since, has been discontinued, and has given way to the simple and continuous paddle-board. These boards, however, are generally placed alternately at greater and less distances from the centre, somewhat like a break-joint. Wooden spokes, with cast iron centre pieces, are generally adopted.

The steam is universally worked with expansion, the valves for its admission and emission being moved independently of each other. A separate engine is generally provided for driving the blowers, and a cylindrical fan-blower is employed for each boiler. Some of these blowers are 10 feet in diameter, being driven by a crank placed on their axle, which receives its motion from the small independent engine.

The great power developed by these river engines is due, not so much to the magnitude of their cylinders, as the pressure of steam used in them. The *New World*, one of the most recently-constructed boats, has a cylinder 76 inches in diameter, and 15 feet stroke. The steam has 40 lbs. pressure in the boiler, and is cut off at half stroke. The wheels, which are 45 feet in diameter, make 16 revolutions per minute. The speed of the circumference of the wheel will therefore be 25 miles an hour; so that, if the speed of the boat be 20 miles an hour, we have the difference, five miles, giving the relative movement of the edge of the paddle-boards through the water.

To ascertain the power developed by these engines, let us suppose the mean effective pressure on the piston, taking into account the vacuum produced by the condenser, and supposing the steam to be cut off at half-stroke, to be 40 lbs. per square inch, the area of the piston being 4536 square inches, and the stroke 15 feet; the piston moves through 30 feet during each revolution of the wheels; and since 16 revolutions take place per minute, we shall find the effective force developed by the piston by multiplying its area, 4536, by twice the length of the stroke, which is 30, and by 16, which is the number of revolutions per minute. This product multiplied by 40, the number of pounds effective pressure per square inch, gives 87,091,200 lbs. raised one foot high per minute, as the power developed by the engine. This is equivalent, according to the

ordinary mode of expressing steam power to 2640 horses power.

Whatever allowance, therefore, may be made for friction, &c., it is clear that the effective power thus obtained must be greater than anything hitherto executed on water.

The increase of the dimensions of these vessels and their machinery has been attended with a greatly augmented economy of fuel.

On comparing the *Hendrik Hudson*, for example, with the *Troy* (a vessel formerly well-know, plying between New York and Albany), it has been found that when the speed of the former is reduced to an equality with that of the latter, the trip between New York and Albany being performed in the same time, the former consumed 13 tons of coal while the latter consumed 20 tons; yet the displacement of the *Hendrik Hudson*, owing to its increased dimensions, is nearly twice that of the *Troy*.

The ease with which these vessels of extraordinary length and beam and small draft move through the water is very remarkable. The results of their performance show that the resistance per square foot of immersed midship section is not perceptibly increased by the increased length of the vessel, and the consequently augmented surface and friction. This anomaly has not been explained, but it is certain that the increased length does not diminish the effect of the moving power in any perceptible degree.

Practical evidence of the economy arising from this increase of power and dimensions is supplied by the fact that the proprietors of the Hudson steam-boats reduced their tariff for passengers, as well as for freight, as they increased the size of their vessels.

Previously to 1844, the lowest fare between New York and Albany, 145 miles, was 4s. 4d. (one dollar). At present the fare is 2s. 2d., and for an additional sum of the same amount the passengers can command the luxury of a separate state-room. When the splendour and magnitude of the accommodation is considered, the magnificence of the furniture and accessories, the cheapness and luxuriousness of the table (each meal, supplied on the most liberal scale, costing only 2s. 2d.), it will be admitted that no similar example of cheap locomotion can be found in any part of the world. Passengers may there be transported in a floating palace, surrounded with all the conveniences and luxuries of the most splendid hotel, at the rate of 20 miles an hour, for less than one-sixth of a penny per head per mile!

It is not an uncommon occurrence, during the summer to meet individuals on board these boats, who have lodged themselves there permanently during a certain part of the season, instead of establishing themselves, as is customary, at some of the hotels in the towns on the banks of the river. Their daily expenses in the boat are as follows:—

| | s. | d. |
|---|---|---|
| Fare . . . . . . | 2 | 2 |
| Exclusive use of state-room, &c. | 2 | 2 |
| Breakfast, dinner, and supper . | 6 | 6 |
| Total daily expense for board, lodging, attendance, and travelling 150 miles at from 18 to 20 miles an hour . | 10 | 10 |

Such accommodation is, on the whole, more economical than an hotel. The state-room is as luxuriously furnished as the most handsome bedroom, and is more spacious than the room in packet ships similarly designated.

To obtain an adequate notion of the form and structure of one of the first-class steam-boats on the Hudson, let it be supposed that a boat is constructed similar in form to a Thames wherry, but above 300 feet long and 25 or 30 feet wide. Upon this let a platform of carpentry be laid, projecting several feet upon either side of the boat, and at stem and stern. The appearance to the eye will then be that of an immense raft, from 250 to 350 feet long, and some 30 or 40 feet wide. Upon this flooring let us imagine an oblong, rectangular wooden erection, two stories high, to be raised. In the lower part of the boat, and under the flooring just mentioned, a long narrow room is constructed, having a series of berths at either side, three or four tiers high. In the centre of this flooring is usually, but not always, inclosed an oblong, rectangular space, within which the steam machinery is placed, and this inclosed space is continued upwards through the structure raised on the platform, and is intersected at a certain height above the platform by the shaft or axle of the paddle-wheels.

These wheels are propelled, generally, by a single engine, but occasionally, as in European states, by two. The paddle-wheels are usually of great diameter, varying from 30 to 40 feet, according to the magnitude of the boat. In the wooden building raised upon the platform already mentioned, is contained a magnificent saloon devoted to ladies, and to those gentlemen who accompany them. Over this, in the upper story, is constructed a row of small bedrooms, each handsomely furnished, which those passengers can have who desire seclusion, by paying a small additional fare.

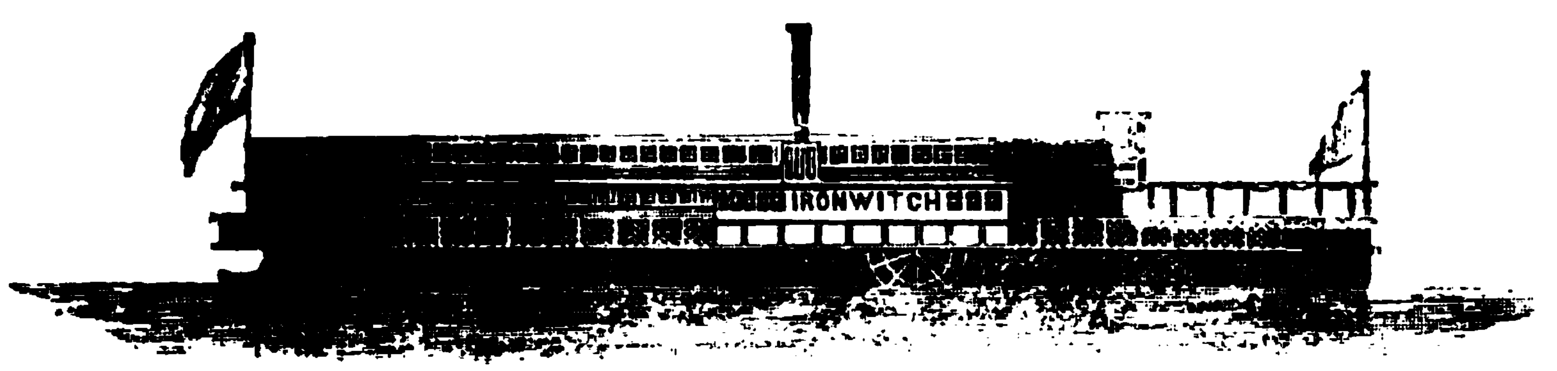
The lower appartment is commonly used as a dining or breakfast-room.

In some boats the wheels are propelled by two engines, which are placed on the platform which overhangs the boat at either side, each wheel being propelled by an independent engine; the wheels in this case acting independently of each other, and without a common shaft or axle.* This leaves the entire space in the boat, from stem to stern, free from machinery. It is impossible to describe the magnificent "*coup d'œil*" which is presented by the immense apparent length when the communication between them is thrown open. Some of these boats, as has been already stated, are upwards of 300 feet long, and the uninterrupted length of the saloons corresponds with this.

This arrangement of machinery is attended with some practical advantages, one of which is a facility of turning, as the wheels, acting independently of each other, may be driven in opposite directions, one propelling forwards and the other backwards, so that the boat may be made to turn, as it were, on its centre. Although, from the great width of the Hudson, no great difficulty is encountered in turning the longest boat, yet cases occur in which this power of revolution is found extremely advantageous.

Another advantage of this system is, that when one of the two engines becomes accidentally disabled, the boat can be propelled by the other.

The general appearance of the Hudson steamers is represented in the annexed engraving of the *Iron Witch*




No spectacle can be more remarkable than that which the Hudson presents for several miles above New York. The skill with which these enormous vessels, measuring from 300 to 400 feet in length, are made to thread their way through the crowd of shipping, of every description, moving over the face of these spacious rivers, and the rare occurrence of accidents from collision, are truly admirable. In a dark night these boats run at the top of their speed through fleets of sailing vessels. The bells through which the steersman speaks to the engineer scarcely ever cease. Of these bells there are several of different tones, indicating the different operations which the engineer is commanded to make,—such as stopping, starting, reversing, slackening, accelerating, &c. At the slightest tap of one these of bells, these enormous engines are stopped, or started, or reversed by the engineer, as though they were the plaything of a child These vessels, proceeding at 16 or 18 miles an hour, are propelled among the crowded shipping with so much skill as almost to graze the sides, bows, or sterns of the vessels among which they pass.

The difficulty attending these evolutions by a vessel such as the *New World*, for example, 125 yards long and 12 yards wide, may be easily imagined; and the promptitude and certainty with which an engine whose pistons are 76 inches in diameter, and whose stroke is 5 yards in length, is governed, must be truly surprising.

The navigation of the other rivers of the Atlantic States differs in nothing from that of the Hudson and its collateral branches, except in the extent of their traffic and the magnitude and power of the steamers. The engines, in all cases, are constructed on the condensing principle; and although steam of 40 or 50 lbs. above the pressure of the atmosphere is frequently used, it is worked expansively, and a good vacuum is always sustained behind the piston by means of the condenser.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 18, 1850.

HENRY WATSON, Newcastle-upon-Tyne, brass-founder. *For improvements in valves and cocks.* Patent dated, October, 12 1849.

The waterway of these improved valves or cocks is opened or closed by moving up or down a conically-shaped block or key, to the inclined surfaces of which are attached,

* The steam-boat, *Empire*, which was recently lost by collision with another vessel, was thus constructed.

by means of bolts and screws, pieces of leather, gutta percha, or other suitable flexible and elastic material. The desired motion is communicated to the key by a screw-rod, which is turned in one or other direction, according as the waterway is to be closed or opened. When the rubbing surfaces or elastic materials are worn out fresh ones are to be substituted in their stead.

*Claim.*—Facing the inclined surfaces of the block or key with yielding or flexible materials.

MICHAEL FITCH, Chelmsford, Essex, patent-salt-manufacturer. *For improvements in baking bread, biscuits, and other matters, which improvements are applicable for drying goods.* Patent dated October 12, 1849.

These improvements consist in placing the furnace or heating apparatus within the oven or drying chamber instead of on the outside, as has hitherto been customary, and causing the flues to communicate with the chimney to prevent the products of combustion from mingling with the atmospheric air of the oven, which is to be constructed of fire clay or of iron-plates, with spaces between to prevent loss of heat. In the drawings which accompany the specification, the oven is represented as having the furnace in the lower part with flues on each side, which extend from one end to the other, and open into the chimney. Above the furnace are fixed any convenient number of shelves, on which the articles to be baked are placed. Care is to be taken to leave spaces between the edges of the shelves and the sides of the oven. Air is admitted to the interior of the oven and furnace, and regulated as desired by means of suitable doors. In large ovens or drying-chambers two or more furnaces may be used as required.

*Claim.*—The mode of heating ovens as described.

CORNELIUS BONNELL, Kempsey, Worcester, engineer. *For certain improvements in rotary engines, to be worked by steam or other means: and also in the construction of carriages, vessels, or other vehicles to be worked by the said improvements in rotary engines or other motive power, and for the machinery connected therewith.* Patent dated October 12, 1849.

The patentee describes and claims:—

1. A rotary engine. The body of this engine consists of a steam casing in the shape of an ellipse or circle, which is keyed upon a hollow shaft, and contains a cylinder also keyed (but eccentrically) upon the same shaft. The external periphery of the cylinder and the internal periphery of the casing are in immediate contact at a point on the vertical right line, passing through the centre of the hollow shaft, and on either side of this point are two ports by which steam is admitted and exhausted. The cylinder is fitted (in the same right line) with two sliding pistons, which are kept in contact with the interior circumference of the casing by two plungers placed behind them. These plungers are pushed outwards so as to maintain the contact between the pistons and the casing, by the elasticity of steam or fluid admitted behind them through the hollow shaft. Steam is admitted by one of the ports, and acting on the piston which, for the time being, projects beyond the circumference of the cylinder, forces it round, and escapes by the other port. The action of the shaft may be reversed by admitting steam through the port which previously served for the exhaust. When it is desired to apply this rotary engine to the exhaustion or forcing of air or gases, rotary motion is communicated to the shaft, and one of the ports connected to the source of supply and the other to the escape.

2. A mode of propelling boats and carriages by means of a flexible rail or rope which is made fast at both ends, and extends the whole length of the intended course of the boat or carriage. This flexible rail or rope is passed between a pair of grooved or other rollers which are to be driven by the improved rotary engine. In case of a boat the wheels are supported in a well, built in the centre of it, while in the case of a carriage they are supported in the under or any other suitable part thereof.

JULES LE BASTIER, of Paris, France, gentleman. *For certain improvements in machinery or apparatus for printing.* Patent dated October 12, 1849.

*Claims.*—1. Printing tissues, papers, and other fabrics with one or more colours by the upper surface of a moveable cylindrical table in conjunction with one or several printing rollers.

2. An arrangement of apparatus for causing the moveable table to approach or recede from the printing rollers, and for maintaining the constant gearing of the cogs, by which these said rollers are put in motion independently of the approaching or receding of the moveable table.

3. Constructing printing rollers cut in relief, and apparatus for regulating their respective positions relative to the moveable cylindrical tables.

4. An arrangement of machinery for adjusting and marking the engraving on printed rollers by the application of drawing points, scoopers, and carriage supporters, either for the purpose of making on the said printing

rollers certain engravings, scraping, dividing, or turning them.

5. Feeding printing rollers by means of an endless web of cloth or felt, to supersede colour rollers.

6. The application of machinery and apparatus for printing with one, two, three, four, five, and even a larger number of colours, and also the union of two machines.

JAMES BANISTER, Birmingham, manufacturer. *For a certain improvement or certain improvements in tubes for locomotive and other boilers.* Patent dated October 12, 1849.

The improvements which are sought to be secured under this patent relate; 1st., to the manufacture of compound tubes for locomotive and other boilers; and, 2nd., to a mode of uniting tubes of copper, brass, and other alloys of copper.

1. The compound tubes are each made of three separate tubes of copper, iron, and brass, which are of different diameters, in order that they may fit one within the other, the copper outside, the brass inside, and the iron between the two. The compound tube is then placed, while in an annealing state, upon a tapering mandril, and drawn through a series of dies where the different metals will be brought into close contact with each other. A tube thus formed will have the advantage of presenting copper to the action of the water, brass to the action of the fire, and will possess the rigidity of iron. When the heat is to pass over instead of through the tubes, then, of course, the brass must be placed outside and the copper inside.

2. The mode of uniting tubes of copper or brass, and the alloys of copper is as follows:—The metal plate is bent into the form of a tube, and the edges thus brought together are chamfered away by an angular file so as to form a kind of trough. The inside of the tube is then filled with sand, and the outside covered with the same substance, with the exception of the trough. The tube is heated to a red heat, and melted metal of the same nature is poured into the trough, the edges whereof will be partly fused, and therefore subsequently united. The superfluous metal is afterwards removed by a circular saw or otherwise.

*Claims.*—1. The manufacture of compound tubes for locomotive and other boilers.

2. The mode of joining the seams of tubes, of copper, brass, or any other of the alloy of copper, for locomotive and other boilers.

JOHN MERCER, Oakenshaw, Lancaster, gentleman, and WILLIAM BLYTH, Holland-bank, in the same county, manufacturing chemist. *For improvements in certain materials to be used in the process of dyeing and printing.* Patent dated October 12, 1849.

This invention consists in making double salts in a solid or concrete state, composed of the oxide of tin, or stannic acid, phosphoric acid, arsenic or arsenious acid, and soda, and which are, or may be called, phospho-stannate of soda, or arsenio-stannate of soda, &c. These double salts, in a dry or solid state are, when dissolved in water, to be used for all purposes in dyeing and printing cottons, mousseline-de-laines, and other fabrics, for which stannate of soda has been hitherto employed; and although the patentees prefer the arsenio-stannate of soda, they state that any of the double salts of phosphoric acid and arsenic or arsenious acid, with soda, potash, or ammonia, may be used. This arsenio-stannate of soda is formed by adding to stannate of soda arseniate of soda (composed by fluxing or heating equal quantities, by weight, of white arsenic and nitrate of soda), in quantities to produce the strongest concrete—this is equivalents of arsenic or arsenious acid and stannic acid. For this purpose they heat 1 gallon of stannate of soda liquor of 50° Twaddle's hydrometer, in an iron vessel over a fire, and mix with it 1½ lbs. of arseniate of soda prepared as before described. A portion of the thin liquor is taken out, and dropped on a cold plate or stone; and if it concretes, the whole may be poured out into a suitable receptacle, to allow it to cool and become solid. The patentees do not confine themselves to this particular mode of adding the arseniate or phosphate of soda (if the phosphate is desired), as the arseniate or phosphate may be added before the tin or soda is made into stannate of soda, and the arseniate or phosphate of soda, or arsenious acid, may be added before, along with, or after the oxide of tin or stannic acid is united with the soda.

*Claim.*—The sole use and manufacture of double solid or concrete salts composed of arsenic or arsenious acid, and stannic acid, and soda, potash, or ammonia; and phosphoric acid and stannic acid, and soda, potash, or ammonia.

WILLIAM STEDMAN GILLETT, Wilton-street, Grosvenor-place, Esq. *For improvements in packing pistons, stuffing-boxes, slides, and other parts of machinery, and in forming bearings, and in making cylinders and other forms of metal.* Patent dated October 12, 1849.

This invention consists in forming the packings of pistons of a number of "dished discs" of any soft or anti-friction metal interposed between top and bottom ones of brass or some other hard metal. The discs are pressed or held together by screwing down the top plate of the piston,

whereby it bears upon the exterior edges of the discs, and keeps them in contact with the inner circumference of the cylinder until they loose their dished form and become flat; after which they may be removed, and fresh ones substituted in their stead. In packing rods and making stuffing-boxes, it is, of course, the inner edges of the discs that are dished, and against which the plate presses. The patentee states, that it will be obvious to every practical engineer that the same principle of construction may be applied so as to serve, at the same time, as stuffing-boxes and bearings for axles and machinery in general. To make cylinders, and other forms of metal where great strength is required, but which are not subject to wear, such as hydrostatic cylinders, it is proposed to use an internal cylinder (although not absolutely necessary), around which are placed a number of dished discs of metal held together by top and bottom plates screwed together.

*Claim.* — Employing a series of dished discs, or plates of metal, for packing pistons, stuffing-boxes, slides, and other parts of machinery, and for forming bearings, and for making cylinders and other forms of metal.

JOSEPH JOHNSON, Huddersfield, York, bricklayer, and JOE CLIFFE, of the same place, iron-founder. *For improvements in furnaces, or in the means of preventing smoke.* Patent dated October 12, 1849.

The patentee describes and claims—

1. A peculiar construction of furnaces for heating atmospheric air by introducing it through a hollow chamber or flat pipe placed immediately over the furnace, or in any other convenient part thereof, into a hollow arch or chamber constructed near the bridge of the furnace, and causing it to issue therefrom and commingle with the products of combustion, and consequently consume them by supplying them with the necessary quantity of oxygen. The incombustible and noxious vapours are exhausted by a fan through a chamber, wherein they are subjected to the action of water or other chemical agent, and absorbed.

2. The employment of the hollow arch or chamber, either in combination with the preceding arrangement or with any other for effecting a like purpose.

3. The employment of a second hollow bridge, in combination with the preceding arrangement, which is supplied with heated atmospheric air, whence it escapes, and mingles with the products of combustion in the flue.

CHARLES ROWLEY, Newall-street, Birmingham, button manufacturer. *For certain improvements in apparatus for weaving, and in articles to be attached to dresses.* Patent dated October 12, 1849.

The patentee describes and claims—

1. A mode of making weavers' mails with tools which were described in the specification of a patent granted to himself and James Turner, November 15, 1842, in such manner that the edges thereof shall be rounded and consequently prevented from cutting the fabric.

2. The employment of one Jacquard for weaving two or more fabrics, by causing the cords of the mounting to pass through a like number of floors, having each a separate loom, and connecting the different working parts of the looms by means of toothed gearing, in order that they may receive synchroneous motion.

3. The application of the Jacquard to produce figures on corduroys and velveteens.

4. Making four-holed buttons of sheet-iron, covered with zinc or other suitable metal.

5. Attaching shank or Florentine buttons to articles of dress by some suitable elasticated fabric.

6. Various modes of making shawl or breast pins, and fastenings for garters and other articles of dress; the main features of which are, protecting the point by a sheath when out of use, connecting the parts by an elastic chain, and rounding the edges to prevent injury to the fabric; also a mode of stamping the fastenings out of sheet metal.

JOHN CHRISTOPHERS, Havitree, Devon, formerly merchant and shipowner. *For improvements in naval architecture.* Patent dated October 12, 1849.

Mr. Christophers describes twenty-five different improvements in constructing and rigging ships. Among the most noticeable of these are the following:—

1. Placing two rudders on either side of the stem-post in the bow of the vessel, instead of at the stern, as hitherto, and placing them so that they shall be totally submerged.

2. Ventilating ships' holds, by constructing waterways between some of the frames, to allow rain or fresh salt water to run down from the deck, and also air-passages in the same manner for the escape of aëriform vapours.

3. Two new forms of sail called "courseon and triangle," which are cut something in the shape of equilateral triangles, the apex of the first and base of the second being uppermost, and rigged to occupy the place of the mainsail.

4. A mode of arranging and fastening ships' timbers.

5. Making treenails and bolts with shoulders and collars.

6. Employing double planking for the sides and decks.

7. Supporting the beams by columns made of bar iron.

8. Strengthening the kelson by attaching iron plates.

9. Making masts and spars of several lengths, fitting one into the other, and encased in an iron cylinder.

10. The use of a mast constructed of five or any other convenient number of spars, arranged in the form of a pyramid, with their lower ends resting on cross pieces supported on the kelson, and the upper ones braced together.

12. A peculiar construction of dead eyes, termed by the patentee "live eyes."

[Of these, Nos. 6, 7, 9, and 10 strike us at once as being of the class of "modern antiques."

ROBERT LARKIN, Ardwick, Lancaster, machinist, and WILLIAM HENRY RHODES, Openshaw, Lancaster, mechanic. *For certain improvements in machinery, and for preparing, spinning, doubling, and weaving cotton and other fibrous substances.* Patent dated October 12, 1849.

The specification of this patent embraces,

1. An apparatus for conducting slivers into cans.

2. Improvements in spindles and flyers, and in the modes of supporting them.

3. A mode of constructing and working mules, in which the spindles are caused to move to and fro.

4. A method of causing the bobbins to drag.

5. An arrangement for taking up the cloth as it is woven.

PETER ARMAND LECOMTE DE FONTAINEMOREAU, South-street, Finsbury. *For improvements in spinning fibrous substances.* (A communication.) Patent dated October 12, 1849.

*Claims.*—1. Replacing drums, strings, or straps, in every kind of spinning engine by a series of cog-wheels to put the spindles in motion.

2. Certain mechanical arrangements for stopping and re-setting in motion instantaneously partially, or singly, and at will, either one or more spindles of all kinds of spinning engines without stopping the working of the spindle.

CONRAD WILLIAM FINZEL, of Bristol. *For certain improvements in the processes and machinery employed in and applicable to the manufacture of sugar.* Patent dated October 12, 1849.

*Claims.*—1. A mode of applying steam or liquids to centrifugal-acting machines when employed in the manufacture of sugar.

2. A mode of preparing sugars for being operated upon by centrifugal-acting machinery.

3. A mode of obtaining from the vapour arising from the vacuum pan the greater portion of the saccharine matter contained therein.

[We shall give, in an early Number, a full description of these improvements, which promise to be of first-rate importance to the sugar manufacture.]

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*Specifications Due, but not Enrolled.*

GEORGE ALOIS RINGELSON, Essex-street, Strand, Middlesex, chemist. *For a composition or preparation for destroying vermin.* Patent dated October 12, 1849.

THOMAS LIGHTFOOT, Broad-Oak, Lancaster, chemist. *For improvements in printing cotton fabrics.* Patent dated October 12, 1849.

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## RECENT AMERICAN PATENTS.

(Selected from the Reports of Mr. Keller, in the *Franklin Journal.*)

FOR IMPROVEMENTS IN MILL SHAFTING. *Edward Bancroft.*

This improvement consists in making the hangers or bearings which sustain the shafts in such a manner that they shall, at all times and under any circumstances, conform accurately to the journals of the shafts, and at the same time not be more liable to be thrown "out of line" than hangers of the ordinary construction; and further, in making the oil-catcher form a part of the box of the hanger, by casting it thereto, thus giving it additional strength without unnecessarily increasing its weight.

*Claim.*—The general arrangement and construction of the complete hanger, with or without the oil-catcher forming a part thereof.

FOR A METHOD OF OPENING, SHUTTING, AND FASTENING BLINDS. *Wesley Chase.*

This invention consists in casting or otherwise securing pinions, of equal size and similar form, upon the stationary and moveable parts respectively of butt hinges, in such a manner that they will both be concentric with the axis of the hinge, and parallel with, and either resting upon or near each other, a turning rack being provided which takes into the pinion of the moveable part, which it turns when moved longitudinally either way, and giving to the door or blind to which it is attached a corresponding motion, until it is brought into the required position, when the rack is turned so as to engage its teeth in both the fixed and moveable pinion, which thus locks them with the parts of the hinge to which they are respectively attached firmly together, and in this manner fastens the door, shut or open, at any required angle.

*Claim.*—The combination of the turning rack with the fixed and moveable pinions attached to the hinge.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Amedée Francis Remond, of Birmingham, for improvements in the manufacture of envelopes. April 15; six months.

Edme Augustin Chameroy, of Paris, for improvements in the manufacture of boilers and of pipes of malleable substances, as well as of elastic matter. April 15; six months.

Robert Reid, of Glasgow, manufacturer, for certain improvements in propelling. April 15; six months.

Cuthbert Dinsdale, of Newcastle-upon-Tyne, dentist, for improvements in the manufacture of artificial palates and gums, and in the mode of setting or fixing natural and artificial teeth. April 15; six months.

John Turner, of Birmingham, engineer, and Joseph Hardwick, of the same place, for a certain improvement or certain improvements in the construction and setting of steam boilers. April 15; six months.

George Attwood, of Birmingham, copper roller manufacturer, for a new or improved method of making tubing of copper or alloys of copper. April 15; six months.

Charles de Bergue, of Arthur-street, London, engineer, for certain improvements in locomotive and other steam engines, also in buffers for railway purposes. April 15; six months.

John Dove Harris, of Leicester, manufacturer, for improvements in the manufacture of looped fabrics. April 18; six months.

William Buckwell, of the Artificial Granite Works, Battersea, civil engineer, and George Fisher, of the Taffball Railway, Cardiff, civil engineer, for improvements in the construction and means of applying carriage and certain other springs. April 18; six months.

William Henry Ashurst, of the Old Jewry, gentleman, for improvements in the manufacturing of varnishes. April 18; six months.

Thomas Ross, of Coleman-street, gentleman, for improvements in machinery for raising a pile upon woven and felted fabrics. April 18; six months.

Abraham Moses Marbe, of Birmingham, chemist, for an improved manufacture of vegetable fluid to be used in the production of artificial light, and in lamps or burners for consuming the same; which vegetable fluid is also applicable to the manufacture of lacker or varnish. April 18; six months.

William Hargreaves the younger, of Bradford, York, iron-founder, for certain improvements in the means of consuming smoke, parts of which improvements are also applicable to the generating of steam. April 18; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| April 13 | 2261 | James Seddon & James Eckersley | Little Bolton | Cop drier. |
| ,, | 2262 | John Porter Abbott, Samuel Wright Wade, and Robert Walshaw. | Liverpool, chronometer and watch-makers | Dead-beat chronometer. |
| 15 | 2263 | John Hendry & James Murphy | Gifford-street, Kingsland-road | Refrigerator. |
| ,, | 2264 | Louise Smallwood | Dunkerque | Improved tile. |
| 16 | 2265 | Scowen and White | 9, Noble-street, Cheapside | Aptandum collar. |
| 17 | 2266 | Francis Herbert Wenham | Brixton | Parabolic reflector for illuminating transparent objects for a microscope. |
| ,, | 2267 | George Kelly Matthews. | Charing-cross, London | Pneumo-monitor. |
| ,, | 2268 | George Frederick Hipkins | Birmingham | Nut-cracker. |

## CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

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## FINZEL'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF SUGAR.

Fig. 1.

Fig. 2.

Fig. 6.

Fig. 5.

## FINZEL'S PATENT IMPROVEMENTS IN THE MANUFACTURE OF SUGAR.

(Patent dated October 12, 1849. Specification enrolled April 12, 1850. Patentee, William Finzel, of Bristol, Sugar Refiner.)

The most important of these improvements has reference to the employment of centrifugal-acting machines (commonly called "Hydro-extractors") to the desiccation and purification of sugar. Of the extraordinary efficacy of these machines in freeing substances from water and moisture, the reader will find some remarkable proofs in an article which we published on the subject two or three years ago (vol. xliv., p. 420); but to this efficacy, the case of sugar has hitherto proved an exception, owing to the meshes of the rotating wire-gauze cylinder becoming, after a few revolutions, stopped up by particles of the sugar. Mr. Finzel has now succeeded in overcoming this obstacle completely, and thereby rendered the desiccation and purification of sugar by centrifugal action so perfect a process, that henceforth there is little chance of any other being employed.

Mr. Finzel's specification embraces two other improvements, which, though of subordinate importance, are also of great practical value; we insert the entire document.

*Specification.*

*Firstly.* My invention consists in a mode of applying steam or liquids to machines used for separating fluids from sugar, by means of centrifugal force, for the purpose of clearing and keeping clear the meshes or apertures in the periphery of the revolving cylinders of such machines. Heretofore, when it has been attempted to extract the molasses or syrups from sugar by centrifugal-acting machines, the sugar has been found speedily to clog and stop up the meshes or apertures in the periphery of the revolving cylinder thereof, and thus materially impede the operation of the machinery.

Now, my improvement in this part of my invention has for its object the overcoming this difficulty. Fig. 1 is an elevation, partly in section, of a centrifugal-acting machine such as is now in common use, to which has been added a steam box or apparatus constructed according to my said invention. Fig. 2 is a horizontal section on the line $a\ b$ of fig. 1. H is a narrow recess for receiving such steam box or apparatus, which is formed in the outer casing A, and is about the same height as the revolving cylinder B. $H^1$ is a steam box or chest, which is placed in the said recess, and is connected by a pipe $H^2$ with a steam boiler, or any other source of steam supply. The box $H^1$ is perforated with small holes on the side opposite or facing the periphery of the revolving cylinder, so that when the steam is let on, it projects jets of steam against the periphery of the cylinder as it revolves, the lids $a^1\ a^1$, serving to prevent such steam from escaping from the machine; a longitudinal section and plan of the box are given separately, on an enlarged scale, in figs. 3 and 4. The mode of operation with the machine, as thus improved, may be thus exemplified:—The sugars intended to be operated upon having been first mixed with molasses or syrups, to bring them up to a proper degree of consistency, are then placed in the cylinder B. Motion is now given to the machine; and after it has made a few turns, the steam, according to my improvement, is to be let on, and allowed to issue freely against the external surface of the periphery of the cylinder for about one minute, which has the effect of clearing and keeping clear the meshes or apertures of the periphery. Then (and without stopping the machine) the state of the sugar contained in the cylinder may be ascertained from time to time during the process by raising the lids $a^1\ a^1$. If the extraction of the moisture from the sugar appears upon inspection to be impeded, the steam is to be again let on for a short space of time, for the purpose of clearing the meshes or apertures as before. The rotation of the machine is to be kept up, and the occasional steaming (when necessary) repeated till the whole, or nearly the whole, of the syrup or fluid is extracted from the sugar; and in operating upon ordinary sugars, the process will generally be completed in a few minutes. Sugars taken from the evaporating pan, after partial cooling, may be placed in the machine, and operated upon in this way; and sugars in this state, of course, require no syruping or mixing.

Instead of steam, liquids may, by means of my invention and of a force pump, or other similar-acting machinery, be thrown against the exterior of the periphery of the cylinder; but, as I believe, with less advantage, and I prefer steam as being, in my opinion, more advantageous.

*Secondly.* My invention consists of a mode of preparing such sugars as require

mixing with liquid before being operated upon in such centrifugal acting machines as firstly hereinbefore mentioned. The apparatus which I employ consists of a vessel with a series of steam pipes fixed therein, and of a centrifugal sieve, and centrifugal drum, fastened on one common shaft, and revolving in such vessel. Fig. 5 is a sectional elevation of the machine, and fig. 6 a plan. A is a vessel having a step, $a^1$, in the centre of its bottom, and in which the shaft B revolves. CC are perforated steam pipes placed under the sieve D, as shown; the perforations being so placed as to cause the steam to be brought into contact with the particles of sugar thrown through the sieve D, which is made of an iron framework $D^1$, supporting a wire sieve, $D^2$. The meshes of the wire sieve are made coarser or finer as it it desired, to divide the crystals of sugar more or less finely. For the better division of any lumps there may be in the sugar, metal points, $d^2$, are fixed to serve this purpose, as shown. As the speed with which the machine may revolve, without throwing the sugar over, will depend on the angle or degree of curvature given to the sides of the sieve, D, that must be regulated to suit the description of sugar to be operated upon. The form shown will be found sufficient for most sugars. A receptacle, G, is made to receive such lumps as may happen to be thrown over the top of the sieve, from which they can be returned into the machine. E is a small centrifugal drum, which is attached to the spindle B. The periphery is perforated, and has divisions or leaves projecting inwards to impart to the fluid the centrifugal force of the speed given. The shaft B is hollow, and has perforations opening into the drum E, in order that the liquid may pass from the former into the latter.

Fig. 6.

Fig. 7.

Fig. 3.

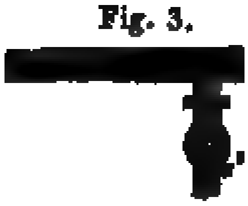

Fig. 4.

The mode of operating with this apparatus is as follows: The machinery being caused to revolve, and steam being admitted by the pipe $C^1$ into the pipes CC, the liquid with which it is intended to mix the sugar is conducted into the drum E, through the hollow shaft B. The sugar having been first prepared by the lumps being broken or crushed, is brought to the centre of the sieve; the centrifugal action

of the machine throws the sugar towards the outside of the sieve, where it becomes divided, and is forced through the sieve. In this divided state the sugar passes through the steam issuing from the steam pipes CC, by which means it is moistened and prepared to receive the syrup which is, at the same time, thrown from the drum E, and, in falling, comes in contact with the sugar, and thus completes the mixing. The quantity of liquid with which it is intended to mix any given quantity of sugar must be so regulated in its admission into the drum E, as that the time occupied in passing such sugar through the sieve shall be the same as the time occupied in passing the given quantity of liquids through the drum E.

*Thirdly*. My invention has relation to the vacuum-pan and apparatus connected therewith ordinarily used by sugar refiners, and has for its object the saving of a portion of saccharine matter which is now carried off along with the steam, or vapour and air, in the ordinary process of boiling. Fig. 7 is an elevation, partly in section, of a vacuum-pan with this branch of my improvements added thereto. A is the vacuum-pan. B the head, to which there is attached a copper pipe C, which leads to a condenser, D. Fig. 8 is a vertical section of the condenser D, showing its internal construction; and fig. 9 is a cross-section of it on the line *a b*. $D^1$ is a metal cylinder with two conical ends, $D^2D^2$, separated from the body of the cylinder by plates, FF, the whole being securely connected together by bolts and nuts, as shown. EE are a series of copper pipes, which are inserted at top and bottom into the plates FF, and establish a free communication between both ends of the cylinder. G is a pipe by which cold water is introduced into the cylinder $D^1$, and around the pipes EE. H is a pipe for carrying off the overflow of water from $D^1$. J is a receiver connected with the bottom of the condenser by a pipe K, in which there is a stop-valve, $K^2$, acting upon the crank handle $K^3$.

Fig. 10 is a plan of the receiver J, with the top removed, showing in the interior an arrangement for evaporating by means of steam pipes, $J^2$, the liquor of condensation, as after described. L is a pipe which forms a communication between the receiver J, and a second condensing vessel, M. This vessel is divided longitudinally near to the top by a perforated plate *m*, which is supported by vertical bearings, $m^1m^1$. N is a pipe by which cold water is supplied to the upper compartment of the condenser M, whence it descends in a shower through the apertures in the plate, *m*, into the midst of, and condenses the aqueous vapour in the lower compartment. O is a pipe which leads to the pumps.

The progress of the operation is as follows: As the vapour arising from the vacuum-pan passes through the condenser D, a portion of it, together with the saccharine matters, are condensed in the pipes EE, and, falling down to the bottom of the condenser, flow into the receiver J, in a state of a weak solution of sugar. Steam being admitted into the pipes $J^2$, the heat thereof (in combination with the action of the exhaust pumps) evaporates the solution to a more concentrated state, when it may be drawn off. P is the pipe by which the concentrated solution is drawn off, and $K^4$ a tap by which air is admitted into the vessel to supply the place of the liquor drawn off. If during this part of the process the pumps are kept still in action, there must be a stop or throttle-valve employed to close the pipe L.

And having now described the nature of my said invention, and the manner in which the same is to be performed, I declare that I claim as my invention,

*First*. The mode of applying steam or liquids to machines used for separating syrups or fluids from sugar, by means of centrifugal force, for the purpose of clearing and keeping clear the meshes or apertures in the periphery of the revolving cylinders of such machines, as before described; but I do not confine myself to the particular apparatus described, which however I believe to be the best adapted for the purpose.

*Secondly*. The mode hereinbefore described of preparing such sugars as require mixing with liquid before being operated upon in the centrifugal acting machines firstly before mentioned.

And, *Thirdly*. The arrangement or combination of machinery hereinbefore described so far as regards the combination of the condenser D, with the other parts of such machinery for the purpose of obtaining from the vapour arising from the vacuum-pans the greater portion of the saccharine matters contained therein, in manner before described.

ANALYSIS OF THE EVIDENCE GIVEN BY THE WITNESSES EXAMINED BY THE COMMISSIONERS APPOINTED TO INQUIRE INTO THE APPLICATION OF IRON TO RAILWAY STRUCTURES.

(Continued from page 309.)

*Peter William Barlow, Esq.*, civil engineer.—425. Has been employed chiefly latterly on the South Eastern Railway.—426. Has not observed much difference in the strength of castings.—431. Has always made the breaking weight of girders six times the greatest load for railway bridges.—434. For other works four times would be sufficient. 435. Proves girders to one-third of the breaking weight, or double the greatest load. — 436. Prefers proving them with actual weight, and giving some vibration to the beam by putting on the weight. — 440. Considers girders will not bear the same weight, when resting on the bottom flange as if applied at top.—441. Has in consequence adopted another form of girder, detailed in Appendix No. 1, the object being to make the bridge one complete plate.—444. Considers 40 feet as the limit for such a bridge.—445. Has made one over a railway at Tonbridge Wells.—446. Finds that the deflections are less than he calculated, from the assistance one part affords to another.—450. Has not observed any injury from the bending of the joists which carry the roadway between two girders.—451. Has not noticed any increase of deflection from a permanent load or from changes of temperature. — 452. Allows $\frac{1}{500}$th of the span for the deflection of a girder. The deflection of the Godstone Bridge is $\frac{1}{810}$th of the span, or $\frac{5}{8}$ths of an inch.—454. Proposes 40 feet as the limit for simple cast-iron girders. — 456. Used a level and levelling staff for obtaining the deflections of the Godstone Bridge. — 458. Considers the girders rest so firmly on their beds, that the deflection observed is not due to any yielding in that respect.—461. Depends on Mr. Hodgkinson's rules for the form of construction for girders. —462. Has made no experiments on the amount of torsion caused by supporting the roadway on the bottom flange of a girder.—464. Considers a girder of separate castings bolted together is a good mode of construction beyond spans of 40 feet.—467. Would not use that method for bridges of 100 feet span.—468. Would limit girders cast in one piece to 40 feet span. —470. Does not consider suspension rods a good mode of combining wrought and cast iron. Would lay a wrought-iron rod along the bottom flange. Assistance given to the extended part of a beam is more effective than when given to the compressed part.—474. To avod a large mass of cast iron, would lay a wrought iron rod along the bottom flange.—475. Does not consider that the different rates of expansion would prevent the wrought iron coming into play.—476. When the bridge gets much load it must come into play.—477. Prefers an arch of cast iron where expense or height is not a matter of consideration.—478. Is making one over the Surrey Canal of three pieces bolted together.—481. Does not consider the vibration on a railway bridge sufficient to disturb the screws.—484. Does not consider that there is much difference of effect between engines going fast or going slowly. Does not think vibration so important as is imagined.—485. Fancied he observed an increase of deflection from engines going fast; there was a great deal of horizontal jar. —486. Which he attributes to blows given by the engine on the rails.—487. Some may be due to the torsion created by the weight being on one of the bottom flanges. —488. Has not observed any change produced in the internal structure of iron from repeated blows at a low temparature. —489. Thinks the subject an important one, and that experiments could be made best by breaking beams which had been long in use. —490. Or testing girders whose previous test had been recorded.—492. Engines and tenders are being made, weighing together thirty-two tons.—493. Engines for inclines weigh as much as thirty tons without a tender.—494, 495. In estimating the greatest load for a railway bridge, considers it covered with a train, or a train composed of engines.—501. Considers the Commissioners might make some useful experiments on the Godstone Bridge.—503. Has paid attention to wrought iron girders.—504. It is desirable in a girder to concentrate the power of resistance as near the top as possible, and the power of extension as near the bottom as possible, which can be accomplished in a cast iron girder; but in wrought iron tube girders the bottom web, which does most work, is a very small proportion of the whole section. — 505. Prefers wrought iron, or wrought iron combined with cast iron to resist compression, to cast iron alone.—507. Considers solid sided wrought iron girders an imperfect mode of construction.—508. Thinks the top of tube girders should be of cast iron.—509. For a large span, considers wrought iron safest.—510. On account of the uncertainty of cast iron would make a cast iron girder 50 per cent. stronger than a wrought iron one.—511. The relative expense would be about half.

*William Fairbairn, Esq.*, civil engineer —511. In early life was a mechanical engi-

neer.—515. Has been employed in engineering works of various descriptions.—518. Thinks Welch cold-blast iron, Blaina, for instance, best for girder bridges.—519. Considers most British irons improved by mixture.—520. A good mixture is two-thirds strong Welch, No. 3, the remainder Scotch or Staffordshire, No. 2, with a little old iron.—521. The same mixture is used in girders for railway bridges and girders to support dead pressure only. Thinks Mr. Morries Stirling's patent for mixing wrought iron with cast iron gives indications of very superior strength, and states the results of experiments upon it; also cites experiments by Mr. Lillie, of Manchester, on the mixture of wrought and cast iron, which proved that the mixture was one-third stronger than common cast iron, and one-eighth stronger than wrought iron to resist transverse pressure.—522. Considers the following mixture of cast iron the best, viz.:—

| | |
|---|---|
| Lowmoor, No. 3 ...... | 30 per cent. |
| Blaina, No. 2 ......... | 25 per cent. |
| Shropshire or Derbyshire, No. 3 ............ | 25 per cent. |
| Good old scrap ........ | 20 per cent. |
| | 100 |

This mixture can rarely be obtained on account of the price of Lowmoor, and founders cannot be depended upon for the exact proportions. Practically he doubts any mixture unless the parties interested were present to witness the selection of the iron, and to see it put in the furnace. Scotch and Staffordshire iron are good for light castings. Good castings depend on the care of the furnaceman, the temperature of the furnace, and the heat at which the metal is run into the mould. Recommends the anthracite iron where rigidity and strength is required.—523. The strongest iron should be put in railway bridges.—525. Considers that the hot blast does not improve the quality of Welch and English irons; but that its application in the Scotch furnaces to the reduction of the black band is an improvement.—526. Scotch hot blast mixes well with Welch irons.—529. The effects of the hot blast vary with the quality of the fuel and ore, and much depends on the quantity of sulphur present in the coal and coke.—530. The Lowmoor ores were injured by the application of the hot blast.—531. Fuel is an important element in the manufacture of iron, the nearer it approaches pure carbon the better.—532. In the Scotch black band and similar ores the hot blast will bring more iron out of the same mine than the cold blast.—533. The hot blast enables the manufacturer to work up not only poorer ores but cinder heaps, into apparently fine granulated iron. The use of the hot blast at first led to the introduction into the market of a very inferior description of iron.—534. Considers the Scotch iron weaker and more fluid than most English irons; it is equal to Staffordshire, but weaker than Welch and Yorkshire.—535. Scotch iron is an exceedingly fluid and fine-working iron, and well-suited to machinery; it runs well into the mould, and brings out the castings with the edges sharp.—536. Does not think the most experienced metallurgist could tell the difference between hot blast and cold blast iron from the appearance.—537. Considers that hot blast presents greater uniformity than cold blast in its granulated appearance, and indicates a more perfect process of crystallization, probably arising from the greater heat of the furnace.—538. In cast-iron girders, would make the breaking weight four times the greatest load.—539. In structures exposed to shocks or vibratory motion would adopt five times or six times. It is safer to adopt a light load, so as to make allowance for casual strains which cannot be computed,—540. Never proves a girder to more than half the breaking weight, generally one-third; disapproves of testing a girder much beyond the permanent load, the object being to ascertain its soundness and its elasticity, a further test tends to permanent injury.—541. In testing girders, carefully inspects the outward appearance, and then hangs weight from the centre, and observes the deflection and permanent set.—542. Does not consider that a permanent set given to beams in the early stages of loading injures the strength.—543. Thinks that within certain limits the form of a beam may be distorted without its strength being injured.—545. Considers that to support the load on one side of the bottom flange is wrong in principle, and to a certain extent, injurious in practice; but the method has many conveniences: to meet the requirements of structures, self-evident principles must in practice be sometimes abandoned. When the load is supported on the bottom flange, the bearing should be brought as close as possible to the central web, by casting a fillet or shelf to carry the cross beams: bolt-holes should be made as near the neutral axis as possible; or when required for bolting wooden bearers to the bottom flange, projections on the bottom flange should be cast to receive them; bolting the roadway to the girders resist, in a measure, any lateral strain on the girders; but the lateral strain is best resisted by broad top and bottom flanges.—546. Considers bolt-holes or other perforations in cast iron girders very objectionable, and they should in no case be made, even through the neutral axis, without thickening the adjacent part to

compensate for the part taken out.—547. These objections arise from considering the complexity of such a girder, and the additional material required to make it equally strong as if plain. Is an advocate for simplicity of construction in everything, and would only allow distortion of form when inevitable.—548. Would prefer supporting the cross bearers on the top flange, or suspending them from the bottom flange by hook bolts.—549. Supporting the road on one side of the bottom flange is wrong in principle, but convenient.—550. If the top flange be broad and rigid, that mode of construction is less objectionable. — 551. It would be advantageous to seek for a new form of beam; a narrow top flange, though well proportioned for vertical pressure, is weak to resist lateral strain. — 552. The practice of supporting the roadway on the bottom flange is simple, cheap, and convenient, and will not easily be abandoned. —553. Recommends a new form of girder to be sought for.—554. To give the girder sufficient stiffness.—555. Has himself always increased the top flange to resist the lateral strain.—556. In a large span with girders having small top flanges, the lateral deflection, if not resisted by a firm connection of the cross beams to the girders, might cause an outward pressure dangerous to the structure.—557. As girders are generally tested to ascertain their soundness, it is usual to apply the test to the top flange, but it would be of great value to test them as they are to be used.—559. The test is usually applied to ascertain the soundness of the casting, the strength being computed at three or four times the load.—560. The joists which support the roadway when carried on the bottom flange, tend to cause by their deflection a lateral pressure on the girder.—561. This effect takes place to some extent in wooden and Sandwich beams; from experiments it appears that this latter description of cross-beam is weak, and its elasticity so imperfect as to render it inadmissible for supporting great weights.—562. The Sandwich beam is objectionable and expensive.—563. Is of opinion that a beam loaded with a given weight even approaching its ultimate powers of resistance, would support the load *ad infinitum* if not disturbed or exposed to changes of temperature; although time is an element in the change which takes place in every material, any increase of deflection in a loaded girder may be traced to atmospheric action, vibration, change of load and temperature: remove these disturbing causes and the deflection will remain fixed. Cast iron of average quality loses strength when heated beyond a mean temperature of 220°; becoming more ductile and less rigid to resist an uniform strain, and becomes insecure at the freezing point or under 32° of Fah.—564. In girders of 40 feet span three-fourths of an inch is the maximum allowable deflection, that is, ·02 inches per linear foot; ·005 inches is preferable.—565. Adopts Mr. Hodgkinson's form of girder modified in the top flange to ensure uniformity in the casting. — 566. Considers 40 feet to be the greatest allowable length between the supports for simple cast-iron girders.—567. Knows an instance of a girder 70 feet long, cast in one piece in Holland.—571. Never heard of a girder breaking by its own weight; a properly proportioned girder could not do so.—572. For spans beyond the limit of simple cast-iron girders which must be passed with a level soffit to the extent of 100 or 200 feet, recommends the wrought iron tubular or box girder.—575. Being a strong advocate for simplicity in mechanical structures, he would not recommend compound girders where they can be dispensed with.—576. Approves of wrought iron tension-rods to girders only in case of necessity and where the top flange is enlarged, but prefers girders of all one material, even if formed in parts. —577. Would rather give strength to a cast iron girder than assist it by a wrought iron truss; the two materials are so widely different in character that it is safer to keep them separate. By screwing up the tension-rods a strain is thrown either on the girder or on the tension-rods themselves; an ignorant person might do injury without being aware of it.—578. When not limited by expense or levels, would prefer for narrow spans a simple girder; for moderately wide spans, the arch; for spans exceeding 70 or 80 feet, the wrought iron girder.—579. Thinks that the vibration to which railway bridges are subject can injure the joints or rivets, unless the work is shamefully executed; nor would impact have any effect on the joints of a well-made cast iron girder.—580. Does not think any effect is produced by the load in skew bridges being alternately nearer one side than the other.—581. It is the opinion of some practical men and philosophers that iron when hammered at a low temperature undergoes a complete change in its internal structure, and that this effect is due to percussion, heat, and magnetism, and time, which is an element in every process of crystallization. The application and abstraction of heat operates more powerfully than probably any other agency: too much influence is probably attributed to the other mentioned causes; a bar of the best wrought iron, heated red hot, and plunged into cold water, is changed from a fibrous to a crystalline body; heating and cooling

will produce this effect in a degree proportioned to the intensity of the heat applied; by annealing the iron its fibrous texture is restored and sometimes made more tough than before. Thinks magnetism may have some effect; but often where causes are inexplicable we fly to electricity for the solution; heating iron to a high temperature deprives it of its magnetic powers which are restored by cooling. Doubts that vibration changes the fibrous structure to a crystalline one, but thinks that each blow produces injury. Axles of a locomotive engine are subjected to repeated shocks from irregularities in the rails and lateral action in passing curves, from a body weighing 18 or 20 tons, moving at 40 miles per hour. Each percussion tends to bend the axles; and from the injury being continued many thousand times, it is evident that time alone will determine the moment of fracture. If the axles were so rigid as to resist the effect of percussion, no injury could ever take place or crystallization appear. A bar beat with a small hammer is not altered at all, but the blows of a large hammer produce a change of form which renders it brittle, not probably crystallizing it. Is of opinion that a fibrous body cannot be changed to a crystalline one by any mechanical process, except when percussion is carried on to the extent of producing a considerable increase of temperature. Fibres may be shortened by continual bending, and the parts be thus made brittle, but fibres cannot be changed into crystals.—582. These changes apply to all materials subjected to repeated alterations of form.—583. Has not traced the breaking of mill work to the change of internal structure. The shafts usually break eventually from getting out of line.—585. It would be interesting and useful to experiment on the above points.—588. The greatest weights on railways may be reckoned at one and a half tons per foot linear for a single line, or two tons per foot for a double line of rails. —589. Considers that recommendations made by the Commission as to particular forms for bridges would probably not be followed, but that experiments would be very beneficial.

*Joseph Glynn, Esq.*, civil engineer.—591. Was engineer-in-cheif to the Butterley Company.—596. Cast iron is always combined with earths, as lime and silica, as well as with carbon; the more pure the iron is the stronger it is.—597. Never saw pure iron.—600. Iron cast from the air furnace of a mottled or of a clear grey fracture, bears the greatest weight.—602. Iron cast from the air furnace is stronger than from the cupola.—605. Doubts the utility of mixing wrought with cast iron for increasing the strength of iron; doubts the complete union of the two.—607. The quality of iron depends, to a certain extent, on the ore, fuel, and flux used; and an experienced person can generally tell what the produce will be.—609. From a reverbatory furnace the required mixture can be invariably produced.—610. The length of time iron remains in the furnace affects the quality.—611. In the air-furnace it is weakened by remaining too long.—614. The best mixture for girders is about one-third of strong crystalline Welch iron with two-thirds of the softer irons of Derbyshire, Yorkshire, or Shropshire.—617. The hot blast of itself produces no effect on iron.—618. It may be used to smelt stubborn untractable materials that would not afford strong iron, and could not be otherwise smelted.—619. In the west of Scotland inferior iron has been produced by means of the hot blast.—622. There is no certain mode of detecting the difference between hot and cold blast iron, but iron of a dark grey colour and very fine in the crystal, is generally hot blast.—628. The difference is more marked as iron is harder.—635. Loam castings are stronger than open sand.—636. Cast machinery required to be very strong from the air-furnace in dry sand.—638. A shaft cast in an upright position is stronger than one cast horizontally, on account of the impurities floating to the top, and the density being increased.—640. Adopts the H form for the section of girders, the bottom flange being largest.—642. Would not make a simple cast iron girder more than 50 feet long.—643. Where spans have exceeded that, has always used the arched form.—651. Built an arched bridge of 70 feet span over the Aire, at Haddesley; and one of 100 feet span over the Trent on the Midland Counties Railway.—654. Would invariably employ an arch when possible.—655. Would not employ wrought iron as an auxiliary to cast iron in point of strength.—656. Would only employ it for bolts; on a large scale the workmanship cannot be so accurate that each will bear its share of the stress.—661. For spans beyond 50 feet, would give the girder as much depth as possible, and join the pieces by bolts and dowels.—662. Would not have a wrought-iron truss.—666. When the workmanship is good does not consider the vibration and impact can effect the bolts and rivets.—668. Believes that the internal structure of iron becomes altered by being submitted to a succession of slight blows at a low temperature.—670. Has seen many axles broken which presented a coarse crystalline fracture.—671. The continual succession of

blows induces fracture, and changes the internal structure of fibrous iron to crystalline, the crystals increasing in size as the effect goes on.—674. Crane chains made of fibrous iron break in a few years with a crystalline fracture.—675. Considers the same effect takes place in cast iron.—678. Shafts in mill-work break.—680. And there appears to be a limit as to time in the durability of wheels.—681. The fractures in these cases exhibit an increased size of crystals.—686. Considers that a stationary weight would deflect a beam more than a moving one.—688. Never made large girders of wrought iron plates; the method is adopted for paddle beams of steam-vessels. —689. Vibration has not affected those made for steam-vessels, nor did the rivets become loose.—691. Considers that the strengh of a wrought iron girder is diminished by rivets. (*See also Appendix No.* 2.)

(*To be continued.*)

### DREDGE'S TAPERING SUSPENSION BRIDGES.

Sir,—At any time I would sooner bridge over a broad river, however rapid, than intrude on the pages of your useful journal; but seeing in a recent Number the Report of the Royal Commission, appointed about two years ago, to inquire into the application of iron to railroad structures, in which it is stated that suspension bridges had been found wholly unfit for such a purpose,—which is in flat contradiction to all that I have advanced on the subject during the progress of the railway system from its infancy,—I cannot let their *veto* pass unnoticed; the more especially as proceeding from such seemingly high authority it may, at home and abroad, do incalculable damage by frustrating the application of iron on the suspension principle to railroad and other structures. I fear that any attempt on my humble part will be of small avail towards repairing the injury. But nevertheless I will, by your permission, offer a few words on the subject.

Iron, as everybody knows, is inconceivably stronger on tension. What then is the common sense state in which it should be placed—on suspension, or compression, or *both at the same instant and in the same structure—each force antagonistic to the other?* I should like to know whether the suspension bridge has ever been tried for railroads excepting the one over the Tweed, which is a bridge on the slack wire principle,—a principle of construction as subject to undulate as the ocean, in any direction by the most trivial force. Such a bridge needed no trial for condemnation; but there are other suspension bridges, and in principle opposite to the slack wire system; and to condemn all for one upon such falacious grounds is unfair. It appears to me the Commissioners stretched the point a little too far, which, like their experiments in stretching iron beyond its proper limit, proved too much. Indeed, there is a strange difference between facts proved by actual experience and those founded on mere conjectural surmises obtained from erroneous data. Now, Sir, having had as much practical experience with the subject as any man ever had, and your, and other scientific journals, home and foreign, having, during the last fourteen years, most extensively promulgated my opinions and the coincident opinions on the subject of many others, men of high standing and of deep research in mechanics, and which being diametrically opposite to the recorded decision of the Royal Commission on this point, it is imperative on me, in self-vindication, once more to state, which I can do from a practical conviction, and with the utmost confidence of its truth, that the tapered supension bridge is subject to less deflection and less injury occasioned by passing loads and atmospheric influence than any other bridge. On this principle a bridge, with room for a double line of rails equal to bear a permanent or transit load of 2,000 tons over the Menai Straits, would require but 300 tons of iron, whilst the Britannia Tubular Bridge will consume nearly 11,000 tons,—enough iron on the taper principle, to construct 35 bridges of the same strength and extent. Besides the astounding economy of material and time in construction, it effects a positive security. The plan was first established in Bath in 1836, and since then in fifty other instances in spans of great extent, by the most leading men in Great Britain, including both the Home Government, and that of India. The latter have applied it to 400 feet spans, and it is capable of spanning, without the slightest risk, any breadth for which funds can be found. There is, in fact, no limit to the principle but the cost,

and after the many years during which it has been tested, and so many bridges have been successfully erected, with the vast attention that has been devoted to the important subject, I think your readers will agree with me, that inasmuch as since its discovery there has never been even the shadow of a proof brought forward to damage its value, it ought not now to be annihilated by the mere opinion of the Royal Commission.

I am, Sir, yours &c.,
JAMES DREDGE.

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## BATTERS, CLEMENTS AND MORTONS' WAGON WEIGHING MACHINE.

[Registered under the Act for the Protection of Articles of Utility. Messrs. Batters, Clements and Merton, of St. John's-Wharf, Millbank-street, Westminster, Coal Merchants, Proprietors.]

Fig. 1.

Fig. 2. Fig. 3. Fig. 4. Fig. 5.

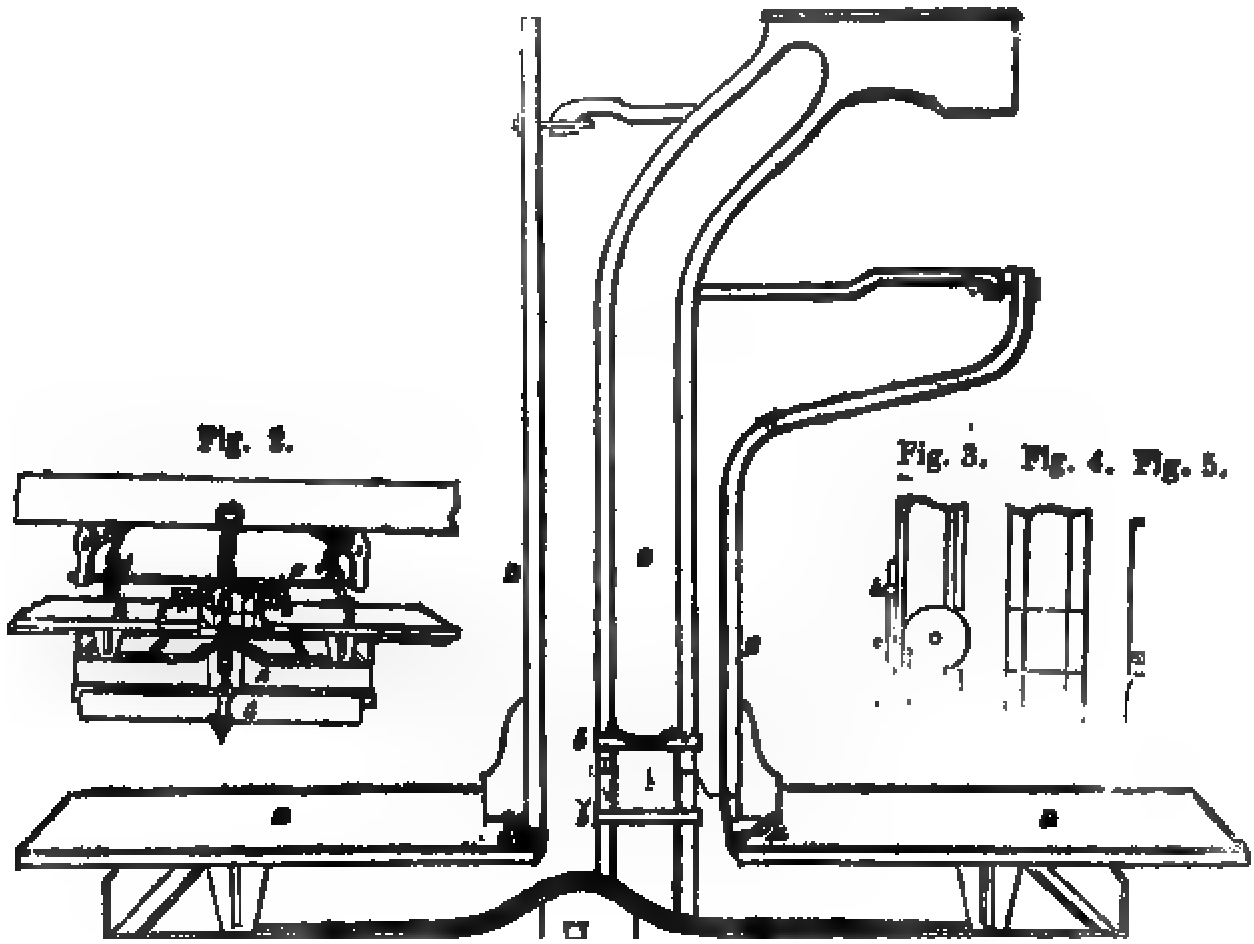

Fig. 1 is a front elevation of this very clever weighing machine in a state ready for use; fig. 2 is also a front elevation of the machine when stowed away for convenience of carriage: figs. 3, 4, and 5 are views of parts of the machine. E, fig. 5, is a knuckle piece attached to the scale-board, over which the rod D D, passes, and is secured by a pin *a*, fig. 1. Figs. 3 and 4 are front and side views of the joint of the standard; *b b*, are two straps, one above, and another below the joint, through which the pin, or staple *c*, is inserted, in order to keep the standard and rods upright. When not in use the machine is in the position under the wagon, indicated at fig. 2, that is, suspended by the chains *d*, *d*, and *e*.

To prepare the machine for weighing: Set free the chain *e*, withdraw a bolt F, secured to the underside of the wagon, and draw out the machine a sufficient

distance, to allow of the pillar or standard to be placed in a vertical position. Then place the end of the plank on which the platform rests, on the bolt F, which will form a lever whereby to raise the machine to the level of the floor of the wagon. Next push in the plank until its outer end comes flush with the platform; after which, raise the standard, or pillar C, and the rods D D, and secure them in a vertical position by the pins and bolts *a*, *a*, and *c*.

To stow away the machine: Remove the pins and bolts, draw out the plank and machine sufficiently far to allow the standard and rods to be laid horizontally, withdraw the bolt F, slide the plank and machine under the wagon, and secure it there by the chains.

A is the platform; B, B, the scales; C is the pillar, which, together with the scale-rods D, D, are made with joints, so that when not required for use they may fold down and form a weighing machine particularly suitable for coal wagons.

## LAST'S TIENT-TOUT, OR RAILWAY PORTMANTEAU.

[Registered under the Act for Protection of Articles of Utility. Samuel Last, of 256, Oxford-street, and 165, New Bond-street, Trunk and Portmanteau Manufacturer, Proprietor.]

Fig. 3.

Fig. 1.

Fig. 4.

Fig. 2.

Fig. 1 is a front elevation of a portmanteau of this improved form of construction; fig. 2, a side elevation; fig. 3, a sectional elevation; and fig 4, a plan of the same when thrown open. A, B, and C, are three separate divisions or compartments, which are hinged, or otherwise connected together in the manner shown; and so arranged as to fold compactly over one another, as represented in fig. 1. The back of the body or principal compartment A, of the trunk, is partitioned off by a plate *a*, and forms a pocket for the reception of boots or other articles. The compartment B, folds over and rests upon a ledge *b*, formed in the sides of A; thus admitting of articles being deposited between it and the bottom of the trunk. The top compartment C, then folds over upon B, and is secured in the usual manner to the sides *e*, of the compartment B.

## MR. VIGNOLES'S PATENT COKE TURF.

We gave recently (current vol. p. 202) the specification of a patent taken out by Mr. Vignoles, for "An Improved Method of Preparing or Manufacturing Peat or Turf for Fuel;" and our attention is again drawn to the subject by a pamphlet which Mr

Vignoles has put forth, in explanation of the value and importance of his invention.* We observe that the pamphlet is printed for "private circulation *only*," but on the same principle we presume that stage soliloquies are not meant to be heard. We do not hesitate, therefore, to quote freely from it.

*European Importance of a Substitute for Coal.*

Wood is still the chief fuel for all purposes in most parts of Europe, Great Britain excepted; but it is vain that the forests are relied upon to supply the great demand—they are disappearing, and wood is every day becoming scarcer and dearer, and many manufactories, dependent for their success (as almost all are) on a cheap and abundant supply of fuel, cannot be established at all, or, where existing, gradually decay; the expense of travelling is also increased, where coal for steam-boats, or coal-coke for railway trains, cannot be readily procured.

In fact the cost of wood begins to be felt even in Russia and Poland, where we might have imagined the supply to be inexhaustible.

In France, in Prussia, and throughout Europe in general, the coal-fields are "few and far between," and seldom of good quality; hence the demand for English coal is becoming great and constant, and whole districts are dependent on this country; so that the least interruption of the supply, whether from natural or political causes, creates the greatest embarrassment.

Two or three facts will fully illustrate this:—

During the recent blockade of the Elbe and of the Prussian ports in the Baltic, the supplies of English coal, from which the Hamburgh and Berlin Railway and other Companies make their coke, became cut off; and if the differences between the courts of Berlin and Copenhagen had not been settled, so far as to raise the blockade, the traffic of the railways must have been stopped, for a while at least, and could only have been renewed by altering the engines and using wood, at infinite trouble, delay, and cost.

In the early part of last December, English coals, transferred from vessels at Dantzic into boats navigating the Vistula up to Warsaw, were kept fast in the ice during the whole winter; the consequence was, that a large iron factory at Warsaw, conducted by some enterprising Englishmen, was greatly embarrassed, and the repairing-works of the Warsaw and Cracow Railway were all but brought to a stand.

And to go further north, the iron establishments in St. Petersburgh, particularly those large ones under the direction of Englishmen or Americans, are virtually dependent on English coal and coal-coke, and are not unfrequently affected for want of it before the end of a long winter; and the great towns of Moscow and Toola, in the interior of Russia, which would compete with the products of Sheffield and Birmingham, draw their iron from the distant regions of Siberia, although some of the districts near them can furnish the finest iron ores, which the scarcity and dearness of wood, chiefly, prevent being advantageously smelted for their use.

*Importance of Turf Coke to Ireland.*

*No country feels the want of coal more than Ireland;* and the object of these pages is to show that Ireland possesses within herself the means of remedying this want.

These means are to be found in *better preparing* the produce of the turbaries which nature has spread over Ireland so abundantly.

From the quantity of moisture in turf, even when well dried in the sun and air, the application of this fuel for great industrial purposes has been equally limited and neglected; and however the choice experiments of patriotic men of science may have pointed to better results, it is practically known that coal at 16 shillings a ton is as cheap, and, if the sods are not well dried, cheaper than turf. It has been ascertained, on a large working scale, under boilers of steam-boats and fixed engines, that the value of good steam coal compared to that of turf is not less than 6 or 7 to 1, often as high as 8 and 9, and sometimes even 10 to 1; and that under a locomotive boiler the value of gas coke above good dry turf exceeds $7\frac{1}{2}$ to 1.

Mr. Mallett, of Dublin, an engineer well known for his scientific acquirements, practical experience, and application of his chemical knowledge to the purposes of his profession, has carefully studied the subject and the history of "*preparing turf for fuel.*" He observes, in one of his publications: "In countries such as Ireland, almost deprived of fossil fuel, *improvements in the preparation* and use of peat, which so abounds, should always be an object of solicitude. Accordingly, though little regarded in Ireland, and commonly viewed as only worthy the attention of the peasant, whose winter comforts depend so much upon its collection, the best methods of preparing

* "Statements Respecting the Method and Cost of Producing Coke from Turf. By Charles Vignoles, Member of the Royal Irish Society, F.R.A.S., M.C.E., &c." 8vo. pp. 47. 1850. (Printed for Private Circulation only.)

and using turf have long formed objects of even national investigation in Continental countries possessing extensive deposits of peat; and in the languages of Denmark, Holland, Germany, and France, an extensive, though little-known, literature on the subject exists. In Ireland attention to the improvement of peat fuel has been rare and casual, and confined to a few individuals, whose energies have unfortunately taken a wrong direction; so that, in fact, the actual practice of collecting and preparing this, the national fuel of Ireland, has always remained unimproved, and is still in its most primitive condition."

Now the object of the process under consideration is to *prepare the turf* in a very perfect but simple and practical way, so as to *produce a fuel equal to coal coke*.

This is attained by subjecting the turf to the action of very hot steam, whereby the moisture is absorbed, and the turf rapidly converted into *turf coke;* little, if any of it, being wasted in the operation.

The weight of the coke thus produced being in proportion to the weight of the turf employed, it is desirable to obtain the most compact turf. That peculiar mode of turf-getting used almost universally in Holland, also that which is called "*Hand-turf*" in Ireland, produces a more solid turf than usually found in bogs; and so will the process whereby the moisture of the turf is expelled by centrifugal force.

### *Commercial Value of Turf Coke.*

The value of *turf coke thus produced has been found equal to* that of *gas coke*, by repeated and careful experiments made at Berlin, in a royal commission of scientific inquiry, instituted by order of the Prussian Government; but the best practical proof that it is so, is to be found in this fact:—Wood being extremely dear in Berlin, gas coke as fuel has been of late years used in that city, selling at a price equal to about 34s. or 35s. per ton. The fuel dealers of Berlin have become acquainted with the *turf coke*, which has been made for some time past in private experiments, to test the value of the invention; and they offer to take as much of this new coke as can be supplied, at a moderate reduction from the price of gas coke, weight for weight.

In Berlin, as in most parts of the Continent, fuel is almost exclusively burnt in close stoves, and the use of open fires is little known, and therefore one of the advantages of the turf coke is not sufficiently appreciated there, although very congenial with English tastes, as it makes agreeable parlour and capital kitchen fires, burning clearly, without smoke, of course, and with a low pleasing-coloured light flame.

For locomotive purposes, successive experiments made during more than twelve months prove that this turf coke is very little inferior to the coke made from Newcastle coal, and that it gets steam up more rapidly. Arrangements are in progress to supply the Hamburgh and Berlin Railway (180 miles in length) with this turf coke, at a price equal to two-thirds of what their English coal coke now costs them, such cost being nearly 40s. per ton. Negociations are also going on to supply some of the iron factories at Berlin with the turf coke, to be used in their *cupolas* for the second meltings, particularly the establishment where the celebrated fine castings of "Berlin iron" are made, this fuel having been much approved there, after trial.

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Let us consider the case of disposing of the turf-coke *in Ireland*.

One establishment, producing ten thousand tons of coke yearly, would not be sufficiently remunerative *in quantity* to allow the additional sum above actual cost to be less than five or six shillings per ton to cover patent-right and profit; still, though partial sales, and to the above extent, might be calculated on, the selling price would come too near that of coal and coal-coke to induce an extended consumption, or to bring on the general application of this fuel to industrial purposes, the introductinn of which into Ireland is the great desideratum for that country.

But, on the supposition of being able to dispose of a large systematic production from a number of establishments, supplying coke in all parts of Ireland for family use, breweries, distilleries, ironworks, railways, inland steam-navigation, and all those numerous purposes for which good and cheap fuel is absolutely requisite, a much smaller profit per ton would yield, in the aggregate, a larger and safer income for the patentee and the enterprising speculator.

In such case, and indeed in any case, even where a small trade were established, several very great economies in making the coke may be introduced, which have not been taken into account in the preceding calculations; such as, the more rapid carbonization of the turf, from previous better drying in the mode specified, thereby producing a larger annual quantity than estimated from the apparatus, the use of the waste coke, not considered merchantable; a quantity sufficient to supply the whole of the fuel for carbonization and drying, when the difference in heating quality between equal

weights of coke and turf is taken into account: and, finally, by using either of the cheap and simple processes by which the turf will be rendered more compact, thereby producing coke not only heavier, but better for fuel in many cases. It is not too much to affirm that *these economies would be equivalent to one or two shillings per ton.*

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Turf coke might then be sold *in Ireland* at *ten shillings per ton*, at the works, at which price it would be *very much below the cost of coal* at the sea-ports, for household purposes, or for steam engines of every kind, on land or water.

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On the Continent, much higher and more certain results of profit are attainable than in Ireland. Coal and coal coke abroad can but rarely come into competition with turf coke produced under this process.

It must, however, be considered that local circumstances will occasion the first cost of making coke to be rather dearer in Prussia, and most other parts of the Continent, than in Ireland. The turbaries are less deep, less abundant, and higher in price, and the cost of all iron work and machinery, and also engineers' wages, are much higher. These circumstances will increase the expenses, and *for the Continent in general, the cost of producing good coke from turf must be taken at* twelve shillings *per ton*: viz.,

| | | | *s.* | *d.* |
|---|---|---|---|---|
| Royalty on the turf ........ | 1 | 8 | | |
| Labour on the turf coked .. | 3 | 8 | | |
| Dito on turf for fuel .... | 0 | 8 | | |
| Cost of turf ............ | | | 6 | 0 |
| Cost of coking ................ | | | 3 | 9 |
| Management .................. | | | 0 | 9 |
| Interest ...................... | | | 1 | 6 |
| Total .................... | | | 12 | 0 per ton of coke. |

There is no doubt, however, that a profit of eight shillings per ton thereon may be had, since at a selling price of twenty shillings per ton, turf coke would be scarcely half the price of the best English coal coke, but sixty per cent. of the price of gas coke, and only half the expense of wood, in all the large towns of Germany.

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That the use of turf coke as a substitute, not only for other cokes and for wood, but also for ordinary air-dried turf, might be calculated upon when once fairly introduced for the use of the inhabitants and manufacturers of the Continent, as well as of Ireland, is manifest from a simple but convincing argument founded on the facts.

> Coal coke and coal are superior to air-dried turf, as fuel, in the proportion, on the average, of 8 to 1; and *turf coke has been proved to be equal to be equal as fuel to gas coke.*
>
> But supposing turf coke to be only equivalent as fuel to three-fourths of the same weight of gas coke, still *turf coke is* 6 *to* 1 *better, as fuel, than air-dried turf.*

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This process of *preparing turf for fuel* has not been brought before the public until its practicability and economy have been tried and proved on a large scale. It is now submitted for the consideration of men of science and influence in all countries where coal is wanting, and it appears *especially applicable to the wants of Ireland*, and to the employment of its population.

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To those who have given even but slight attention to the subject, it cannot fail to be obvious that numerous branches of employment may be opened up in Ireland, when once a supply of fuel, fit for raising steam and applicable to all industrial purposes can be depended upon at the low price stated. One branch of occupation alone would be of the very highest interest, and is not too much to impute its realization, viz., the working of the rich iron ores of the Queen's County, Lough Allen, and other districts. Many of these ores produce iron of a quality equal to the best Swedish, and it is on historical record that when wood abounded in Ireland, the make of iron there was greater than it was in England.

This new method of obtaining a coke (which is particularly, perhaps absolutely, free from sulphur), when made from the most compact turf, may be looked forward to for restoring the trade of making iron in several parts of Ireland; for the superior quality of the metal would command the English market, and enable it to compete with the best iron imported from Sweden.

## THE BRIDGE OVER THE RHINE AT COLOGNE.

The following letter has been sent us for publication. The following will, we believe, be found to be a true account of the circumstances which have led to its appearance:—During the course of the last autumn, Mr. Fairbairn, of Manchester, was induced by representations made to him through a high official functionary to propose to the Prussian Government a plan for an iron bridge across the Rhine at Cologne on the tubular principle. This plan met with the entire approbation of the scientific world at Berlin, was sanctioned by the King, and was all but adopted by the Prussian Cabinet. It happened, however, that simultaneously with the proposal of Mr. Fairbairn, one Oberbaurath Lentze had become convinced that a suspension bridge was the true means of communication across the Rhine. He had arrived at this conclusion after years of patient investigation, and so far is worthy of all praise, though it somewhat unfortunately chanced that his discovery was some thirty years too late, so that his labours, which would have been at the height of science in 1820, have only served to illustrate a job in 1850. Here in England we have some little notion of the nature of jobs, but we question whether any more colossal in this kind has ever been perpetrated in our palmiest days of corruption than the attempt of our worthy friend Herr Van der Heydt—in whose paper, if we are not mistaken, the celebrated figment of the payment of 6,000*l.* to the editors of the *Times* by the Danish Government first appeared—to bolster up the scheme of M. Lentze and to throw cold water upon that of Mr. Fairbairn. What mattered it that Baron Humboldt, the Nestor of physical science, sided with Mr. Fairbairn, or that the King of Prussia in one of his happy moments had graciously extended his royal protection to the English engineer? Was not M. Van Heydt, and the whole army of the Russian Bureaucracy, whose name is Legion, arrayed on the other side? Still the English scheme must be *burked* officially; it was to be smothered in due form with the cushion of Bureaucracy; so a commission was appointed to inquire into the English tubular bridges, and of whom do our readers suppose that it consisted? Why, of Herr Oberbaurath Lentze himself and another person, who, after due deliberation, set off for England on their scientific mission. Why need we detail at length the wanderings of these Duumviri of Bureaucracy?—how they landed in England—how they were received with marked courtesy by Mr. Fairbairn—how they saw the Conway Bridge, the Britannia Bridge, and other structures of minor dimensions in Lancashire? Suffice it to say that they were quite blind to the merits of tubular bridges, and made their report dead against tubular and strongly in favour of suspension-bridges—a report which was adopted by the Government—that is to say, by Herr Van der Heydt—who forthwith issued his famous notice, calling upon the engineers of the whole world to compete for the honour of contributing to the glorification of Herr Oberbaurath Lentze, whose plans have been long since lodged in the *bureau* of M. Van der Heydt, and in all probability will be ultimately carried out.—*Times.*

### *Letter. Wm. Fairbairn, Esq., to Baron Humboldt.*

"My dear Baron Humboldt,—I gather from an article which has recently appeared in the *Times* newspaper, and from a communication which his Excellency M. Van der Heydt has honoured me with, that a most unfortunate decision has been come to by the authorities at Berlin with reference to the important structure by which it is intended to connect the opposite banks of the Rhine at Cologne. It having been my good fortune to have been consulted, many months ago, on the subject of this important bridge, and to have visited Berlin for the purpose of submitting my proposals, I hold it due to the warm recommendation which emanated from our excellent friend in London, the Chevalier Bunsen — to the lively interest you manifested in favour of the object of my journey—and also to the gracious approval expressed by His Majesty the King of Prussia in person—to make known as widely as possible the insuperable objections which, in my opinion, attach to the limited programme which has recently been issued from the bureau of the Minister of Public Works.

"So far as words can be allowed to convey an intimation of a genuine conviction, M. Van der Heydt acknowledged at the palace, on the 1st of November last, that no structure should ever be allowed to cross the Rhine which was not calculated to meet with perfect security the utmost requirements of the most extended traffic, and the possible contingencies of great military operations. Your own enlarged conceptions at once prompted you to acknowledge that the design (which, at that time, had received the sanction of the authorities) was totally unfit for these purposes, and to admit that a suspension-bridge, owing its strength to a flexible catenary, was inade-

quate to the transport of heavy weights. But when I submitted the results which had been accomplished in this country by the judicious application of a material until recently untried in such structures—when I announced the successful realization of one of the boldest conceptions of modern times—when I stated that tidal streams, such as the river Conway and the Menai Straits, had been crossed by solid and unyielding bridges of enormous span, which were capable, nevertheless, of sustaining ten times the greatest possible strain that the heaviest railway traffic could, in practice, subject them to—when I had shown that this new principle of construction was peculiarly adapted to surmount the numerous difficulties which the passage of the Rhine offers, by requiring very few and comparatively small piers in the stream, and thus allowing of the passage of large timber rafts in the summer, and offering the least possible resistance in times of floods and breaking up of ice in the winter, and, above all, when I had proved that a structure so much superior could be erected and fixed at an outlay considerably below that which had been demanded for a very imperfect one—I confess I was not prepared to find the minister of an enlightened and powerful people asking for the assistance of the world at large to perpetuate a scheme unworthy of Prussia, unworthy of the practical scientific knowledge of the age, and in opposition to the deliberate and carefully weighed opinion of science's greatest ornament.

"Pardon me for the warmth with which I address to you this remonstrance; but I feel that your unwearied exertions and the friendship which you unreservedly testified to me call upon me to urge as forcibly as I can the retracing of the unfortunate steps already taken. We live in times of progress. A scientific discovery or a practical improvement of any kind cannot be confined to a particular locality or to one country; it becomes at once the property of all. This community of knowledge—the most powerful destroyer of national prejudices and antipathies, as it is the surest foundation for general and permanent peace and good will, must ride over and bear down individual ignorance and petty bureaucratic objections. Punctuality and rapidity in our intercommunications have become almost essentials of our existence; and in this manner all Europe may be said to be interested in the completion of that railway system which will traverse the Prussian dominions from one extremity to the other.

"And now let me point out the lamentable imperfections which characterise the Ministers' programme, and the limitations and requirements which will effectually trammel the efforts of men of genius, and deter those of experience and reputation from entering at all upon the competition.

"It is an express condition of the scheme that the railway communication is not to be continuous, and the public will therefore continue to suffer the annoyance and inconvenience of considerable delays; for it may be safely said that the proposal of disintegrating a train at one terminus and drawing it across to the other by men or horses, bit by bit, and hour by hour, will offer equal, if not greater, obstacles to a rapid journey than the existing system does. How much better would it be that the bridge should embody within itself such elements of strength and durability as would afford at all times and in all seasons a safe transit to those means of locomotion which constitute the wonder and glory of the age! Instead of such a permanent and substantial structure, will the Prussian Government sanction the erection of one, the feeble and rickety constitution of which would shudder at the very sight of a locomotive? Surely not! Public opinion must step in and forbid it. What is wanted is a bridge to connect the existing railways, not one that will permanently separate them.

"But, again, it is stated that the difference between the levels of the existing railways and that required far the roadway of the intended bridge is too great to be overcome by the locomotive within a short distance of length. This objection is purely imaginary; for I can state, from personal examination, that the necessary gradient would not be so heavy as several which are worked with great ease in this country. Besides, on the left bank of the Rhine the terminus of the Aix-la-Chapelle line is at the right level; and that on the side of Deutz may without difficulty be reached by an easy gradient of less than 1 in 100.

"Without meaning the slightest disrespect to the author of the design for the chain bridge, I must repeat my firm and deliberate conviction, that it would prove an incomplete and unsatisfactory structure. A permanent, inflexible, durable, and handsome bridge, of enormous strength,* adapted, by arrangements which I have now in progress of execution for similiar purposes in this country, to give every possible facility to the navigation of the river—calculated to carry across the heaviest railway train at

"* The breaking weight of the bridge I proposed, with the span of 310 feet, was equal to 6,000 tons or 120,000 cwt., equally distributed over each span, giving as the ultimate strength of the bridge, with four spans, 24,000 tons, or 480,000 cwts."

any speed, and which you might cover with the most powerful ordnance from end to end, may be erected at Cologne within the sum which has been demanded for the chain bridge. These statements are not the imaginings of a sanguine mind; but their accuracy may be corroborated by numerous examples of a similar character which have been erected in this country.

"If, therefore, the determination of the Minister of Public Works to erect a chain bridge cannot be shaken, I confidently anticipate that such an event will not be allowed to pass by without a strong protest on the part of those who are in advance of the knowledge and judgment displayed by the authors of the invitation which has been issued to the engineering world.

"My letter has attained a much greater length than at first anticipated. My anxiety to forward your own forcibly expressed views on the subject of a fixed bridge must be my apology for it.

"With an expression of my profound esteem, and with best wishes for your continued good health,

"Believe me to remain,
"My dear Baron Humboldt,
"Your very faithful & very obedient servant,
"WILLIAM FAIRBAIRN.

"Manchester, April 15."

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING APRIL 26TH, 1850.

GEORGE SHOVE, Deptford, Kent. *For improvements in manufacturing ornamental surfaces when glass and other substances are used.* (A communication.) Patent dated October 18, 1849.

The various modes of producing ornamental surfaces described by the patentee are as follow:—

1. Producing imitations of marble, agate, jasper, and other natural stones, by splashing, painting, or printing the desired pattern, in oil or varnish colours on a water-bath, as is well understood by paper-stainers, and laying on it a glass slab, the surface of which has been previously coated with varnish or siccative oil, to prevent water getting between the two, and to ensure adhesion. The body colour or ground of the stone to be imitated is then laid on, and the whole subsequently varnished over. Or, the pattern in oil or varnish colours may be applied to paper coated with a watery gum, and then applied to the tacky surface of a glass slab, after which the paper and gum are to be removed by washing, and the colours varnished over. This process allows of the ornamenting of tubes or other hollow articles. Any suitable cement may be afterwards added, and the articles applied to the internal and external decorations of buildings, appartments, furniture, domestic purposes, &c.

2. Imitating on slabs of glass the various substances alluded to with colours, which vitrify on being subjected to heat, by means of a bath as before described, or by graining tools.

3. Imitating wood on glass slabs in like manner to what is ordinarily practised, with the exception that the varnishing and last or finishing touches are in this case the first.

4. Printing any desired pattern by means of a bath composed as before-described, and covered with a pellicle of soap, formed by pouring in soapy water, on which the required pattern is printed by points or by edges suitably arranged,—the soap serving to confine the pattern in its bounds. Care must be taken not to twist the points on withdrawing them.

5. Forming letters of glass by forcing it up into moulds, and producing an ornamental surface by any of the preceding methods. These letters are to be cemented in their places, and are intended chiefly to supersede the brass letters affixed to shop fronts.

6. Ornamenting and silvering talc.

7. Placing an ornamental fabric between sheets of glass.

8. Transfering marbled or veined designs to lithographic stones in lithographic ink, by the use of a water bath instead of the ordinary method.

9. A method of obtaining stereotypes or engravings by coating wood with a preparation of wax or other suitable substance, which is then to be engraved to the required depth, and the cast, or impression in copper, taken from it. The plate is then to be ground down to the depth of the wax and finished off.

[The greater part of the preceding list of improvements, the 1st and 5th in particular, are manifest infringements of Miss Wallace's patent. See vol. xlix., p. 224]

DAVID HULETT, of Holborn, Middlesex, gas engineer, and JOHN BIRCH PADDON, of Lambeth, Surrey, gas engineer. *For improvements in gas-meters and in gas regulators.* Patent dated October 18, 1850.

*Claims.*—1. An improvement in the syphon of gas meters, whereby it is limited in its use to the passage of gas exclusively, and all access to it from the outside is excluded.

2. An addition to gas-meters of an indicator for exhibiting at all times on the dial-plate the height of the water in the meter, such indicator being actuated by means of a float rising or falling with the water.

3. An improved overflow valve, whereby any abstraction of gas through that valve is

rendered impracticable, and several modifications thereof, as also any other modifications of which the same may be susceptible.

4. An addition to the ordinary syphon of gas meters of a weighted lever-valve, for the prevention of fraud from tilting.

[Should the meter be tilted up ever so little for the fraudulent purpose of displacing part of the water from the drum, and causing, to the extent of such displacement, more gas to pass through the meter than is registered, the weighted lever instantly brings the valve down upon the mouth of the pipe, and stops the flow of the gas.]

5. Certain arrangements for regulating the flow of gas by the application of a column of mercury.

[We shall give a full description of the improvements, 1, 2, 3, and 5, with engravings, in our next.]

WILLIAM WYATT, Waterloo-cottage, Oldswinford, Worcester, pump-maker. *For improvements in coating the surfaces of vumps, pipes, cisterns, and other articles of iron.* Patent dated October 18, 1850.

This invention consists in coating the surfaces of articles made of cast iron, with a glass or glaze prepared as follows:—Three parts, by weight, of white lead, or one part red lead, or two parts white lead; two parts of borax, and one part of calcined flint, are heated to a temperature sufficiently high to fuse them, and then run into water (by preference, although not absolutely necessary), after which they are ground up with water in a glaze mill to the consistency of cream. If the inside of the article is to be coated, then all openings are closed except one, through which a quantity of glaze is introduced. A rotary motion is then given to it in order to cause the glaze to adhere to every part. If it is the exterior that is to be coated, it is brushed over with, or dipped in a bath of glaze. In either case, the surplus glaze is allowed to run off. The article, thus coated, is lastly placed in a kiln, but in such manner that no part of the glaze surfaces shall be exposed to the action of flame or sulphur, and heated until the glaze melts (which can be easily ascertained by removing a brick from the kiln). When this occurs, the kiln and its contents are allowed to cool until the glaze is set, and adheres firmly to the surfaces of the articles to which it has been applied.

*Claim.*—Coating with a glaze, such as herein explained, cast-iron pumps, cast-iron pipes, cast-iron cisterns, and other articles of cast-iron.

JOSEPH STOVEL, Suffolk-place, Pall-mall East, Middlesex, tailor. *For improvements in coats, part of which improvements is applicable to sleeves of other garments.* Patent dated October 18, 1850.

Mr. Stovel proposes—

1. To make a coat with double fronts, in order to protect the wearer from cold and rain, and which has the appearance of two coats. The under one is made in the usual manner, and may be of a different colour to the fronts, which are attached to it at the collar seams, the elbow seams, and beneath the arm seams, to about the depth of six inches, being buttoned the rest of the way.

2. To dispense with the use of buttons or hooks and eyes at the wrists of sleeves, and to insert at the openings narrow ribbons composed of silk warp and elastic weft, which are fastened between the inner surface of the cloth and the lining, so as to allow of the passage of the hands through, and then collapse around the wrists. Instead of an elastic fabric, springs may be used.

*Claims.*—1. Making coats with double fronts.

2. Making sleeves of coats with elastic fabrics, or springs introduced at the wrist.

THOMAS DAWSON, Milton-street, Euston-square, machinist. *For improvements in cutting and shaping garments and other articles of dress for the human body.* Patent dated October 18, 1850.

The patentee employs a machine to cut several pieces of cloth at the same time, somewhat similar to what has already been used to cut gloves, with the exception that the position of the cutters may be varied so as to produce different shapes. This machine consists of a top plate perforated with numerous holes, in which are held, by screw nuts, a number of standards. These standards have collars that bear against the under part of the perforated plate, and are thereby prevented sliding up. The cutters, some of which are hinged, and the rest capable of sliding one over the other, are held in the lower part of the standards, and are retained in position with regard to one another by screws. The machine is placed in a screw press, and the layers of cloth put under the blades or cutters, which, when forced down by the application of pressure, will divide them into the required shapes. When fustians are to be cut, it is proposed to make the edges of the cutters serrated.

*Claim.*—Composing apparatus for cutting or shaping parts of garments or dress, by so arranging the cutters that they may be varied in their combination and position, so as to vary the shape of the cuts made by such cutters.

ETHAN CAMPBELL, New York, philosophical, practical, and experimental engineer and artizan. *For certain new and useful improvements in the means of generating and applying motive power and in propelling vessels.* Patent dated Oct. 18, 1850.

The patentee describes and claims,

1. An apparatus for obtaining vapour from alcohol or other vaporizable substance, and applying it to motive purposes.

2. An apparatus for propelling vessels by the ejection of a column of water from the stern.

Charles Felton Kirkman, Argyle-street, Middlesex, gentleman. *For certain improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances.* Patent dated October 18, 1849.

The improvements sought to be secured under this patent embrace,

1. Giving a twist to the roving or yarn, and winding it on to the bobbin without the twist being removed. 2. A mode of giving the traverse motion, for laying the yarn evenly on the bobbin from end to end. 3. A peculiar construction of presser or presser-guide. 4. A method of constructing spindles. 5. New spring top bearings for flyers. 6. Pressing the rollers together by means of springs instead of weights. And 7. Doubling, drawing, and spinning slivers in one apparatus, and at one operation.

1. The permanent twist is given to the roving by the following means: The flyer-frame has two slots, one on either side, to receive the cheeks which support the axle of a cylinder, and allow it to slide up or down. This cylinder, which is roughened or fluted on its periphery, is caused to bear against the bobbin by having its axle also supported in elastic bearings, and receives rotary motion which it transmits to the bobbin. The roving or yarn passes from the delivery rollers, through a trumpet-mouthed tube to the presser guide, which lays it on the bobbin evenly from end to end, having the twist given to it by the revolutions of the flyer.

2. The traverse screw, which effects the to and fro motion of the presser guide, has right and left-handed threads cut upon it, and receives rotary motion, through the intervention of toothed gearing, from the axle of the cylinder. The presser guide slides on a bar and carries at the lower part a stud which takes into the one or other of the threads of the screw, the ends whereof are so cut that when the stud has arrived at the end of one thread it shall be transferred to the other, and thus made to travel to and fro alternately.

3. The presser guide has affixed to the upper part of the body, which is made with a slot and slides on a bar above the bobbin, a finely tempered steel spring, the free end whereof bears on the bobbin and is made with an eyelet, through which the roving or yarn passes.

4. The lower part of the flyer is made solid, and rests upon the tapering point of a fixed spindle, over which slides a tube connected by a bayonet-joint to the flyer. Upon the tube is a pulley, which receives rotary motion by a band from any prime mover, and imparts it to the flyer. The spindle carries at the upper part a bevel toothed wheel, into which gears another bevel toothed wheel (supported in the flyer-frame) which communicates, through the intervention of toothed gearing, with the axle of the cylinder. The bevel wheel on the spindle being stationary, and the other being carried round it in the frame, causes the latter to revolve on its own axle, and to communicate this rotary motion to the cylinder, the traverse-screw, and the bobbin.

5. The spring-top bearings consist of a tube connected to the frame at one end, and having a bearing at the other, which encircles the top of the flyer. Within the tube is a piece of India rubber, which is attached at one end to the fixed part of the joint, and at the other to the bearing part, so as to allow for any irregularity in the movement of the flyer.

6. The shoulders of the drawing rollers are formed with shackles, the links thereof being connected together by a screw, which are attached to a spring, like a spring balance, the other end of which is fixed to the frame. The screw connection admits of the distances between the links of the shackle being varied, and, consequently, of regulating the pressure of the rollers.

7. To effect the doubling, drawing, and spinning of rovings in one machine, and render their removal at the termination of each operation unnecessary, the patentee proposes to employ three sets of rollers, and to place between the first and second a pair of rollers, to the upper one of which is given a longitudinal traversing motion, in addition to the rotary one, for the purpose of gathering up and compressing the fibres of the rovings, by means of right and left-handed threads cut on a portion of its axle, into which takes a fixed stud.

The claims embrace the various improvements, as described in the specification, and shown in the accompanying drawings.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Peter Arkell, of Chapel-street, Stockwell, Surrey, engineer, for improvements in the manufacture of candle wicks. April 20; six months.

Alfred George Anderson, of Great Suffolk-street, Southwark, Surrey, soap manufacturer, for improvements in the treatment of a substance produced in soap-making, and its application to useful purposes. April 20; six months.

John Timothy Chapman, of Wapping, Middlesex, engineer, for improvements in apparatus for setting up ships' rigging and raising weights. April 20; six months.

Richard Archibald Brooman, of the firm of J. C. Robertson and Co., of Fleet-street, London, patent

agents, for improvements in the manufacture of zinc, and in the apparatus employed therein. April 20; six months.

Henry Ritchie, of Brixton, Surrey, for improvements in the manufacture of copper, brass, and other tubes or pipes. April 23; six months.

William Macalpine, of Spring Vale, Hammersmith, general dresser, and Thomas Macalpin, of the same place, manager, for improvements in machinery for washing cotton, linen, and other fabrics. April 23; six months.

Charles Humfrey, of Downing College, Cambridge, M.A., for improvements in the manufacture of candles and oils, and in treating fatty and oily matters, and in the application of certain products of fatty and oily matters. April 23; six months.

Antoine Pauwels of Paris, France, merchant, and Vincent Dubochet, also of Paris, France, merchant, for certain improvements in the production of coke, and of gas for illumination, and also in regulating the circulation of such gas. April 23; 6 months.

Richard Laming, of the New Chemical Works, Isle of Dogs, Middlesex, chemist, and Frederick John Evans, of the Horseferry-road, Westminster, gas engineer, for improvements in the manufacture of gas for illumination, and other purposes to which coal gas is applicable, in preparing materials to be employed in such manufacture, and in apparatus for manufacturing and using gas; also improvements in treating certain products resulting from the distillation of coal, parts of which above-mentioned improvements are applicable to other similar purposes. April 23; six months.

Edward Newton, of Chancery-lane, Middlesex, civil engineer, for improvements in casting type. (Being a communication.) April 23; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in the manufacture of wafers, and in the machinery or apparatus connected therewith. (Being a communication.) April 23; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for a new and improved mode of conducting, consuming, and disengaging smoke from its deleterious compounds. (Being a communication.) April 23, six months.

Ernst Werner Siemens, of Berlin, Prussia, electric engineer, for improvements in electric telegraphs. April 23; six months.

Joseph Jean Baranowski, of London, gentleman, for improvements in machinery for counting, numbering, and labelling. April 23; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| April 18 | 2269 | Richard Edwards | Bow | Knife-cleaning apparatus. |
| 19 | 2270 | A. Marshall and Co. | Park-side, Hyde Park-corner | Part of the apparatus used in corsets, denominated The "Corset a tous Resorts." |
| 20 | 2271 | J. Robertson | Emmett-street, Poplar | Apparatus for giving signals by sound. |
| ,, | 2272 | Mary Ann Nash | Paul's-cray Mill, Kent | Impressing surface of a dandy roller, for producing water-marks on machine-made paper. |
| ,, | 2273 | John Weems and Thomas Buchanan | Johnston, Renfrewshire; Bridge of Weir, Renfrewshire | Cover for carding and drawing-frame cans, applicable to cotton, flax, and woollen factories. |
| ,, | 2274 | Alfred Gregory | St. George's-street East, London | Safety plate for a ship's scuttle. |
| ,, | 2275 | Henry Potts | Brooke-street, Holborn | Postage-stamp damper and affixer. |
| 22 | 2276 | Reeves, Greaves, and Reeves | Birmingham | Sword tang. |
| ,, | 2277 | William Horne | Long-acre | Barouche, or barouche phaeton. |
| 23 | 2278 | Robert Waddell | Liverpool | Capstan. |
| ,, | 2279 | Crosse and Blackwell | Soho-square | Stopper for glass and earthenware bottles and jars. |
| ,, | 2280 | Thomas Kerslake | Exeter | Boiler and furnace. |
| 24 | 2281 | William Alex. Adams | Midland Works, Smethwick, Staffordshire | Carriage spring and centra clip. |
| ,, | 2282 | Nicholas Downing | The Phœnix Foundry, Shildon | Cast-iron railway carriage-wheel. |
| 2225 | 83 | John Finlay | Glasgow | Radiating register stove. |

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# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1395.] SATURDAY, MAY 4, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## MESSRS. HULETT AND PADDON'S PATENT GAS METERS AND GAS REGULATORS.

Fig. 1. Fig. 2.

Fig. 7. Fig. 5. Fig. 6.

## MESSRS. HULETT AND PADDON'S PATENT GAS METERS AND GAS REGULATORS.

(Patent dated October 18, 1849; Specification enrolled April 18, 1850.)

Messrs. Hulett and Paddon have patented several improvements in gas meters, which promise fair to be of great practical utility. Even already, though but six months have elapsed since the sealing of the patent, their improved meter is in extensive demand.

Some effectual mode of keeping the water charge constantly adjusted to the true working level has long been felt to be a desideratum. The present patentees have made a near approach to this desirable result by exhibiting the actual level of the water to the eye on the face of the dial-plate, so that the consumer may at all times satisfy himself whether or no any more than the proper charge of water is contained in the meter; whilst the inspector, on going his rounds, will perceive at a glance any deficiency in the correct water level.

This indicator of the water level is represented in fig. 1, and thus described:—

A is the ordinary float-valve, to the bottom of which there is attached a curved rod or wire *a a*, the longer arm of which passes up through a tube C into the small box G, which encloses the registering machinery, and carries at top a pointer *c*; *k* is a vertical slot made in the dial-plate, up and down which the pointer *c* is free to move; and *l* is a mark on the dial-plate, which indicates the true level to which the water in the meter should at commencement be adjusted. As the float rises or falls, the pointer *c* necessarily rises or falls with it above or below the standard point *l*, and thus becomes a constant indicator of any escape or deficiency of water in the meter. Instead of the long arm of the rod or wire *a a* forming itself the pointer, it may be made to act on a separate pointer having a horizontal motion, and indicating on the segment of a circle the degree of divergence from the true level of the water; but we prefer the arrangement we have described as, on the whole, much simpler and more satisfactory. If preferred, also the indicator may be connected to a separate float; but this we deem superfluous.

It is well known that gas may be easily drawn off unregistered from the ordinary syphon-plug screwed at the bottom of meters, and also from the side or overflow pipe (after sucking out the water, which can be done notwithstanding the dip-pipe), by fitting on to those orifices a moveable and flexible tube (vulgarly called a "Jemmy"), which, on the approach of the inspector, is removed, the screw-plugs being then replaced as before. Messrs. Hulett and Paddon have effectually closed the door to these frauds by the several methods which are described as follows:—

### *As to the Syphon Plug.*

In the common water meter, the gas is conveyed into the measuring drum by a curved pipe or syphon, both ends of which are left open. From the curved end of this pipe a straight tubular piece projects downwards, and is closed at bottom by a screw-plug accessible from the outside, the use of which additional piece and plug is to enable the syphon to be occasionally employed for the collateral purpose of drawing off any excess of water which may accumulate in the meter and interfere with its due action. But there is nothing to prevent parties fraudulently disposed from making use of these additions to the syphon for the purpose of drawing off gas (instead of water), without its passing through the drum; and no doubt this is frequently done. Now to prevent the possibility, in future, of such an abuse, we do away with the plug referred to altogether, and make use of the syphon for its single legitimate purpose of conveying the gas from the inlet box to the drum. Fig. 1 is a front elevation, and fig. 2 a side elevation of a gas meter in which the preceding and other improvements included in our invention are embodied, parts of both figures being in section. B, fig. 1, is the syphon. Both legs are carried higher than usual, and the ends of both are enclosed in covers inaccessible to the water, one by a cover $B^1$ placed inside the drum, and the other by a cover $B^2$ attached to the front of the meter. All access to the syphon from the outside is thus excluded, and any fraudulent abstraction of gas through that part of the apparatus rendered impossible. We still leave a short tubular piece *a* projecting downwards from the bottom of the syphon as shown in fig. 2; but it is for the purpose only of receiving any moisture which may arise from the condensation of the gas.

### *As to the Overflow Valve.*

*Thirdly*. Our improved overflow valve, is so constructed that it can be applied to that purpose alone, and cannot be used under any circumstances for the fraudulent abstraction of gas. A section and plan of this portion of our improvements are given, on an enlarged scale, in figs. 3 and 4. $A^1$ is a waste reservoir formed on one

side of the square box in front of the meter; this reservoir is closed at bottom, but open at top for the reception of the surplus water when the proper level is exceeded. $B^2$ is a vertical pipe enclosed in $A^1$, which is open at bottom, but closed at top; and $b^2$ a mouthpiece, which branches off at right angles from $B^2$, and has a screw-plug F fitted to it. M is a cylindrical float which encircles $B^2$, and is free to move up and down it. N is a conical valve placed inside $B^2$, the spindle of which is attached by a cross piece to the bottom edges of the cylindrical float M. As water flows over into the reservoir $A^1$, it raises the cylinder M, which, by its ascent, opens the valve N, and admits the waste water into the pipe $B^2$, from which (on that pipe being filled) it may be drawn off by taking out the plug F. When the cylinder M falls, the valve N drops with it into its seat, and now serves to close the tube $B^2$ against the passage of any gas in that direction. The plug F may then be taken out, but neither water nor gas will follow.

A modification of the preceding apparatus is represented in fig. 5. $A^1$ is a reservoir, formed as before, at the side of the square box in front of the meter. $B^2$, a tube which occupies the centre of that reservoir, but does not descend quite to the bottom thereof; at top, this tube is soldered to a corresponding aperture in the reservoir, and at bottom it has an opening, $b$, which the float-ball $A^0$ fits upon. F is a mouth-piece and plug, as before described. When the meter is charged with water, and the reservoir, $A^1$, is, consequently, also filled, the ball $A^0$ floats at the top, but as soon as the water descends so far as to leave the tube $B^2$ free, the ball falls down upon the aperture $b$, and prevents the exit of any gas through that part of the reservoir communicating with the mouth-piece F.

Another modification of this part of our invention is shown in fig. 6. $A^1$ is an outer case. $A^2$ is a compartment formed at the top of the case, which is constantly open to the inflow of the surplus water, but is closed at bottom on the line $a\,b$. $A^3$ is a central tube, similar to the tubes $B^2$, of the preceding arrangements, which has a float valve, B, adapted to the top of it, and opens at bottom (only) into the portion A of the case which surrounds the tube and communicates with the mouth-piece, F. The overflow water rises in $A^2$ till it raises the float B, which allows it to pass over, into, and down the tube $A^3$, from which it ascends in $A^1$ to the mouth-piece, where it is discharged. It follows that until the float B is raised, there can be no communication between the mouth-piece and the interior of the meter, and that the water which serves to raise that float must serve also to seal the mouth-piece against any escape of gas. The moment there is no water interposed between the mouth-piece, F, and the interior of the meter, the valve B drops of necessity into its seat, and prevents any flow of gas towards the mouth-piece.

Fig. 7 exhibits an arrangement, which is precisely the same in all respects as fig. 6, with the exception that in place of the float valve used to close the top of the central tubular compartment $A^3$, a hollow cap is used.

Sometimes the water charge, after being properly adjusted by the inspector, is tampered with as soon as his back is turned, by tilting the meter forwards. This position causes the water level to subside from the drum or measuring wheel towards the front of the meter, which then registers in favour of the consumer, just as if it were *undercharged*. The patentees have put a stop to this fraudulent practice also by the following simple contrivance:—

B, fig. 8, is the ordinary syphon pipe; $B^1$ a valve, which fits the mouth of the inlet arm of the syphon, the spindle C of which valve is swivelled to the back of the same arm of the syphon. A weight E is attached to the lower end of the spindle, so as to throw up the valve and leave the inlet arm of the pipe open as long as the meter is on an exact level; but should the meter be tilted up ever so little for the fraudulent purpose above mentioned, the weight instantly brings the valve down upon the mouth of the pipe, and stops the flow of the gas.

Now that the wet gas meter has been so much improved by Messrs. Hulett and Paddon's contrivances, we shall expect to see it coming more into vogue than ever; for it is, after all, when properly constructed and adjusted, the most correct measure of gas yet known.

The last of Messrs. Hulett and Paddon's improvements which we have to notice, is an apparatus for regulating the flow of gas through pipes, so that whatever may be the pressure of gas in the street mains, an uniform pressure may be maintained in the passage of the gas through the burners:

A sectional view of this apparatus is given in fig. 9. A is the inlet pipe from the meter or gas main; B the pipe leading to the burners; C is a chamber containing a lever D, which is centred at $D^1$. To the longer arm of the lever D there is affixed a conical valve E, which regulates the flow of gas into the pipe B. F is a bent pipe or inverted syphon, which is filled with mercury up to the line $a\,b$. When gas is admitted into the

instrument, the greater the pressure with which it is forced through the pipes, the more it will press upon the surface of the mercury in the limb G of the syphon, whereby the counterpoise weight H will descend, and cause the valve E to close up the aperture in the pipe B, and so equalize the flow of gas according to the pressure. I is a counterpoise, by which the action of the instrument can be adjusted to any degree of pressure; this counterpoise can be screwed further out or in upon the lever at pleasure, by undoing the screw-cap K. L is another screw cap for adjusting in like manner the floating counterpoise K. Other modes of applying a mercurial column to equalize the flow of gas may readily be devised; but we prefer that which we have described, and do not confine ourselves to any particular mode.

## SARDINIAN STEAM-FRIGATE "GOVERNOLE."

This fine war-steamer, which left the Thames on Sunday last, affords a fresh example of the superiority of English-built ships and machinery. She was built by Mr. Pitcher, of Northfleet, for the service of the Sardinian Government, and presents a noble appearance on the water, with every indication of proving a fine sea vessel. She is of the following dimensions, viz.: Length, 213 feet; breadth, 37 feet 6 inches; depth, 23 feet; burthen in tons, 1389.

The engines are by Messrs. Maudslay, Sons, and Field, on their double-cylinder principle, and of the combined power of 450 horses. The boilers are so constructed as to be very low in the vessel; the situation best adapted for a man-of-war; and her paddle-wheels are provided with disengaging apparatus, so that the vessel may readily be put under sail only, when required. This arrangement of engines was introduced by the firm of Maudslay, Sons, and Field, in 1841, since which time they have manufactured engines of 15,370 horses power under their patent.

The speed of the *Governole*, as ascertained by running to and fro between the Nore and Mouse light-ships, is upwards of 11 knots an hour, though fully equipped in every respect, having her coals and heavy armament on board.

## ANALYSIS OF THE EVIDENCE GIVEN BY THE WITNESSES EXAMINED BY THE COMMISSIONERS APPOINTED TO INQUIRE INTO THE APPLICATION OF IRON TO RAILWAY STRUCTURES.

(Continued from page 329.)

*William Henry Barlow, Esq.*, civil engineer.—699. Is resident engineer to the Midland Railway.—701. Has found so much difficulty in obtaining the quality of iron specified that he now simply specifies the dimensions of the girders and the test to the iron is to be submitted, leaving the mixture to the founder.—702. Objects to the inferior qualities of cinder iron and hot blast iron generally; though, at times, hot blast iron exhibits good results.—705. Some specimens of hot blast are as strong as cold blast.—706. Hot blast iron seems more liable to abuse in manufacture than cold blast.—707. Is not aware of any mode of telling hot blast iron from cold blast.—708. Specifies that girders should bear a given weight with a given deflection.—709. Would make a girder so that the breaking weight should be four times the greatest load.—710. Considers that safe for weights moving at high velocities.—711. Proves a girder to half the breaking weight.—712. It gives the girder a permanent set, but does not consider that it injures its strength.—713. The proof is proportioned to what the girder has to bear.—714. Test them by dead pressure by the hydraulic press.—717. Has not tried impact, during the test, but thinks it might be desirable when the breaking weight of the girder is nearly approached; but, practically, would give a large amount of surplus strength.—718. Never allows the load to exceed one-fourth of the breaking weight; it is often one-fifth.—719. The pressure being applied in the central plane of the girder.—720. In actual structures the pressure is usually applied to one side of the bottom flange, but does not consider that when the surplus strength is so great and the iron good that it is of importance to apply the test in the same way.—722. A torsion is introduced; it is not, however, so perceptible in short girders.—731. The effect of a great permanent load on girders is not in operation in railways; but girders do not appear to be deteriorated by the frequent passage of a load.—733. The $\frac{1}{40}$th of an inch to a foot is assumed as the amount of deflection that may be allowed, in girders, but it is empirical.—736. The short time which a load rests on a railway girder apparently renders the weight of less effect than in warehouse girders which bear a large load for years.—737. Observed once on a timber viaduct that a goods' train produced a certain amount of deflection; an express train coming afterwards, though with a lighter engine, seemed to produce a wave through the bridge, and evidently pro-

duced a worse effect than the goods' train.—738. The point of maximum effect would not be when the load was in the centre of the bridge.—739. And this is probably a reason for allowing girders to deflect less in railway bridges than when exposed to dead pressure only.—740. Has generally adopted Mr. Hodgkinson's form of girder.—742. In spans of 50 feet, wherever the headway allows, prefers and has adopted arched girders, which are supported by abutments, and also act as girders; they are of great strength.—746. A skew bridge on that principle is a series of square bridges.—747. The arched girder for the bridge over the canal at Wheelock is in two pieces, bolted together in the middle; the rise is $\frac{1}{10}$th.—750. There are cases where on account of headway rectangular openings are required, but they are rare; girders have been used to a greater extent than necessity required, from being in fashion.—753. The length for cast iron girders will be limited by the power of casting them; has not used any longer than 42 feet.—755. The bowstring bridge is the best mode of construction where the spans are not too large for simple girders, a cast iron arch with a wrought iron string.—761. In a very large structure the rise of the arch might allow of a pair being tied together at the top.—762. If in combinations of wrought and cast iron, the two metals are bolted side by side, the different rates of expansion might produce a bad result.—764. Has not found that the impact and vibration to which railway bridges are subject has produced any bad effect on the bolts and rivets of bowstring girders.—766. The girders in skew bridges might, if the deflection were excessive, suffer from the load coming on the centre of one girder before it comes on to that of the other.—767. Except at high velocities the maximum effect will take place when the load is at the centre. 769. To try the effect of impact of trains, whitewashed the rails for a mile on an incline of 1 in 316, and watched the effect of a fast train of twelve carriages going down it over them; in cases of imperfections at the joints, there were spaces 5 inches in length untouched by any wheels in the train.—775. The rails weighed 78 lbs. and were on wooden sleepers.—777. Used to use felt as an interposing medium to diminish vibration, which answered for light engines; the present ones are so heavy that any substance is soon crushed out.—778. Some engines weigh nearly 30 tons; a new one on four wheels weighs 32 tons.—781. Has observed that the internal structure of small pieces of wrought iron becomes altered by blows.—782. Caused a piece of the best and most fibrous wrought iron from the Lowmoor works to be hammered by blacksmiths for 10 minutes, and quite a change in the texture was produced; by continuing the hammering for half an hour, it was altered from a fibrous to a granular texture.—785. Axles are not exposed to the same sort of blows as hammering gives; but axles have broken with a crystalline fracture.—791. The very heavy engines lately introduced begin to crush the rails; eight tons on each wheel seems beyond what the rails as now constructed can carry.—796. The wheels of the large engine above mentioned are 16 feet apart.—798. It has travelled with two carriages at 78 miles per hour.

*Robert Stephenson, Esq., M.P.* civil engineer.—807. Mentions that it is well known that the fluidity of Berlin iron is due to the presence of arsenic, and that the Welch and Yorkshire irons are contrasted by the one being hot short and the other cold short, which is due to the presence of phosphorous on the one hand, and manganese on the other.—808. Used two or three cwt. of the new iron from India; but the workmen did not understand it; it retains its malleable properties to a high temperature, and then looses them very suddenly and becomes fluid.—810. Mr. Morries Stirling's method of introducing wrought iron into cast iron, is a commercial question, unless it gives more flexibility or toughness to the cast iron and makes it approach the quality of wrought iron, for if the additional quantity of common iron required to make up for the difference of strength can be introduced at less expense than his mixture can be procured, he would be beat out of the market.—811. Weight is, however, an important element in steam boats.—813. Prefers a mixture of irons wherever it can be obtained, without having any specific opinion as to which mixture is best.—814. Made several experiments on mixtures at Newcastle; does not think the difference between any irons so great as to make it worth while incurring additional expense; 5, 6, or 7 per cent. is probably the range on one side or the other from the medium of all the irons in this country; when using hot blast iron, alters the constant in Mr. Hodgkinson's formula to make up for any defect in quality.—815. Hot blast iron being very fluid, is better adapted for small articles than cold blast; it appears to approach the Berlin metal.—816. Would use either hot blast or cold blast iron, but prefers a mixture.—817. Though you may specify that the iron be without cinder, you cannot ensure getting it.—818. Has not found much difference between anthracite and other iron.—819. The large castings for the bridge at Newcastle are of anthracite and hot blast from the neigh-

bourhood. — 820. Considers that there is very little difference between the strengths of different irons, and that it can always be made up by varying the constant in the formula.—822. Never met with iron varying 15 per cent. from a standard.—823. Is of opinion that, taking the average of irons in this country, there is a great proximity to an uniform standard; irons vary to a small extent on each side of that standard.—824. Though one iron compared with another may give a great difference of strength, a mixture, for which all engineers stipulate, annihilates these variations.—825. Always adopts Mr. Hodgkinson's formula.—826. Adopts the constant he gives, viz., 25 or 26 with a mixture; if compelled to use hot blast iron, would take 20 as the constant, this number being derived from experiments. — 829. Has not the same confidence in hot blast as in cold blast iron, rather from opinion than experiments. — 830. Understands that the fracture of hot blast is darker and more carbonaceous than cold blast, which should be a dull lead grey.—831. Generally employs six times the working load to be the calculated strength of a girder, and tests it with a weight equal to two trains of locomotives, or two tons per foot in length.—832. Has added to the bridges built on the plan of the Dee Bridge, three castings corresponding to the lower ones, by means of which the line of thrust is raised above the horizontal line.—833. The deflection of a bridge of 96 feet span so altered was 1·96 inches with 56 tons in the centre, equal to two trains of locomotives; it is rather too stiff; considers that a certain amount of flexibility in a cast iron girder is essential to resist the suddenness of the passing weight; it should yield so as not to convert pressure into concussion.—834. Tests large compound girders to one-third the breaking weight, and small simple girders to one-sixth.—835. Tests small girders with the hydraulic press; large girders, with dead weight, suspended from the centre.—836. —Iron clamps holding the bottom flange support the platform for the testing weight.—838 The weight is applied in the centre.—839. In bridges it is applied on one side, but the torsion so created is very inconsiderable and may be disregarded.—841. It is not necessary to test girders with weights applied as in practice; the beams that form the platform rest close to the vertical web.—843. When girders have been tested accidentally in that way, has not found any difference; when two girders are tried by the hydraulic press it is by accident only that the pressure is exactly in the vertical plane.—845. Does not consider that alterations take place in iron bridges from length of time or change of temperature; the engine beam of a Cornish engine, with a 90-inch cylinder, receives a shock 8 or 10 times a minute, equal to 55 tons; has known them work for 20 years without the smallest perceptible change. —848. On the Blackwall Railway, 120,000 trains, each of 12 carriages, have passed over girders of 48 or 50 feet span, and when examined four or five months ago, no perceptible change had taken place. — 849. These girders were not made to carry locomotives, and they are doing as near their ultimate duty as girders carrying locomotives; with respect to the question of change in the internal structure of wrought iron, knows of no instance where some important link was not wanting to complete the reasoning; that hammering may produce brittleness in iron is probable but not certain; the connecting rod of a steam engine vibrates at ordinary speeds eight times in a second; one just come into the shop from the Norfolk line has run 50,000 miles; the rod has vibrated 25,000,000 of times; yet, apparently, no change can be detected.—851. With respect to axles, has never been able to come to a conclusion whether the axles that broke were fibrous to begin with.—852. The connecting rod being so much smaller, is more likely to be fibrous; a piece of iron rolled from 1 foot to 20 feet is almost necessarily fibrous; but when rolled from 1 foot to 6 feet it is not necessarily so. —854. Does not believe any change takes place in cast iron.—855. Considers $\frac{1}{40}$th of an inch to a foot may be allowed as the deflection for a girder.—856. Considers the deflection from a moving train to be less than that from one at rest.—857. There may be a lateral strain, but is satisfied that the vertical strain is less.—858. Adopts Mr. Hodgkinson's form of girder, with slight variations according to circumstances.—859. Usually puts two girders under one rail with a baulk of timber between for short spans; in some cases it is desirable to have no top flange.—860. With statical pressure adopts three to five as the proportion of the top to the bottom flange.—861. The difficulties of casting prevent the theoretical proportion being always the best.—862. In very large girders has sometimes adopted Mr. Hodgkinson's proportion of 5 to 1. — 863. In some cases has made the top and bottom flange equal; although some part of the metal may be thrown away as far as strength is concerned, it is very useful for other purposes.—867. Has made cast iron girders 50 feet long, but now limits them to 40 feet, and then uses wrought iron.—868. For small spans almost invariably uses two girders, with a baulk of wood between, under each rail; it is a convenient way of disposing of

the material and getting sound castings, and they are easily handled.—876. They are being used at the Penmon Mawr, where there are 19 spans of 35 feet each.—877. The timber forms a cushion for the rail.—880. In bridges beyond the limits of cast iron girders considers that girders formed of separate castings, with a tension rod along the bottom is as good a form as any; but considers that there is this advantage in having the tension rods at an angle, that you can bring the tension of the wrought iron into play so easily.—882. When such a bridge is wanted on a large scale, the vertical elevation might be divided.—885. When the joints are planed and fitted accurately, such a girder would be as secure as a solid one, as in a large mass the construction from cooling is liable to be unequal.—887. Has tested compound girders without any bolts and depending on the tension bar, and also without the tension bar, but depending on the bolts.—888. The extension of tension bars with ten tons per square inch is $\frac{1}{1000}$th of the length, and the iron comes back to its original state.—889. The piston rods of Cornish engines go on without being lengthened.—891. Tension rods will not permanently suffer as long as the strain is within the limits of elasticity.—893. With respect to the tension rods in the Dee Bridge which acted at an angle, does not allow the objection that with deflection they might become slackened, but would undertake to break the tension bars by putting on a strain, and that the girders can be cambered by them.—895. Would use wrought iron girders over spans where there was no limit as to expense or levels.—896. Thinks that a bar of wrought iron cast into the bottom flange of a cast iron girder might be too intimate an union on account of the different rates of expansion of the metals; if, however, the proportion of cast iron to wrought was very large, it would not be of so much consequence.—901. It is much the same as bolting a wrought iron bar to the bottom flange of a girder.—903. Does not consider that the vibration and impact to which railway bridges are subject would injure the bolts and rivets.—905. Has observed one or two instances when oscillation was produced on skew bridges when the road has not been in good order close to the bridge, and one wheel came on to a solid angle when the other was on soft ballast; generally now brings the two sides square by means of a wooden baulk.—906. In skew bridges, when oscillation is prevented, both girders are subject to the same vibration.—908. The deflection of a girder would not throw the engine into oscillation; the engine moves at the rate of about 70 feet per second, and there is not time.—910. The deflection of the girder is only a small objection. The approach to the bridge causes the danger.—914. Considers experiments on impact and vibration advisable.—917. An ordinary train weighs about five-eighths of a ton per foot in length. Engines are about a ton to a foot in length.—920. Considers wrought iron girders preferable to cast iron for spans exceeding 40 feet, as being more elastic.—923. Found a very marked effect from introducing a cast iron top in the box girder in the Chalk Farm Bridge.—925. Considers a collection of facts would be very valuable, but any legislative enactment, with reference to the construction of bridges which would hamper engineers, would be very objectionable.—930. Attaches very little importance to vibration, and considers it of little consequence for girders to be laid on ordinary walls without interposing medium.—951. Considers suspension bridges very little applicable to railways; indeed, with the prospect of increasing weights, totally inapplicable.—834. Thinks Dredge's principle scarcely applicable with heavy weights.—935. The more ties they have to the platform the better.—936. Has been informed that a train passing over a suspension bridge at Stockton, of 300 feet span, caused a wave 2 feet high like a carpet.—938. Understands that American engineers have given up lattice bridges entirely; they soon rack themselves to pieces; the timber is cut into slices instead of being in lumps.—939. The thin bars of an iron lattice bridge make it impossible to convey compression through them; it is "wabbly."—940. Sir John M'Neil has remedied the want or power to resist compression by putting a cast-iron top.—1039. Exhibited drawings of the wrought iron girder for the Chalk Farm Bridge, with a cast iron top to resist compression. The method adopted to strengthen girders on the Dee Bridge plan, and girders with tension rods along the bottom flange for bridges over the river Arno.—1042. Also an experimental girder, similar to the Dee Bridge girder, from which it appeared that the tension rods, when acting at an angle, could camber the girder.—1045. Girders are made in separate pieces on account of the difficulty of cooling large masses, and the inconvenience of conveying them. 1049. Thinks it would be imprudent to make larger castings than those recommended for girders. Has had failures. In Appendix No. 4 are experiments on various sorts of iron made before commencing the high level bridge at Newcastle.—1050. Although there is a considerable variation in

**the strength of iron, there is a remarkable approximation to an average standard.—1062. Practically an engineer is not justified in going to any great expense to get a particular quality of iron.—1067. A difference of 20 per cent. in samples of iron is not of much consequence when the girders are made to bear six times the load that comes upon them.—1069. Does not consider that any injury can arise to a girder from the bending of the joists supporting the platform; in many cases has had the bearing secured close to the central web.—1072. Prefers, instead of depending on one girder, having two bolted together, with a baulk of timber between.—1073. Prefers a wooden platform to one resting on iron beams; does not apprehend danger from the vibration, but the noise is so unpleasant that some soft medium should always be interposed.**

(*To be continued.*)

THE HOLYHEAD AND DUBLIN STEAMERS.

Sir,—Most persons are aware that the passage between Holyhead and Dublin was one of the first selected by the early promoters of steam navigation for their experiments on the open sea; and it is not a little interesting to those who, like myself, take an interest in the subject, to review its past history, and note its present state on this station. The distance from Holyhead to Howth, the original Irish packet station, is 54 miles; to Kingstown, the present one about 58. A passage better calculated to test the qualities of a seagoing steamer could not be chosen; for at times a more turbulent sea does not exist than is experienced on it. This is principally owing to the strong tides, the force of which is principally felt in the neighbourhood of the Welch coast. The spring tides here are known to run at the rate of 6 miles an hour. One of the captains of the old sailing packets, in his evidence before a Committee of the House of Commons in 1822, stated, "I do not think I ever saw a more difficult channel to navigate, and I think I have now been forty years at sea."

In 1819, David Napier placed on the station the *Talbot*, of 156 tons, built by Wood, of Port Glasgow, and fitted with two engines of the collective power of 60 horses, by himself. This was the first attempt; but though he may have continued running his vessels on other lines through the winter, it is certain that the *Talbot* did not ply for more than the summer and autumn of that year. In the following year (1820) Napier placed another vessel, the *Ivanhoe*, of 158 tons, built by Scott, of Port Glasgow, with engines of 56 horses power, by himself, on the same line, but I cannot find that either this or the *Talbot* ran regularly throughout the year. Enough, however, was done to induce the Postmaster-general, who then managed the packet service, to take the matter up; and, in 1821, steamers were regularly introduced between Howth and Holyhead for the conveyance of the mails, and partly superseded the old sailing packets. The *Ivanhoe* was purchased for this purpose, and two other steam vessels ordered to be built; these were the *Royal Sovereign* of 200 tons, and the *Meteor* of 190 tons; they were built by Evans, of Rotherhithe, under the direction of Oliver Lang, the master shipwright of Woolwich Dockyard, on the diagonal principle. It is a little singular that 27 years later, almost on the same spot, on the same principle, and from the design of the no less celebrated son, O. W. Lang, was constructed the *Banshee*. The *Royal Sovereign* and *Meteor* proved very successful vessels; and so important was strength then considered, that, excepting the Discovery ships, Lang declared that he knew of none stronger. The engines of each were made on the beam principle, by Boulton and Watt—the power of the *Sovereign* being 80, that of the *Meteor* 60; and it is curious now to find the commander of the former vessel, in his evidence before the Commons' Committee of 1822, giving it as his opinion that, if anything, she was overpowered. We find it stated elsewhere, in the same evidence, that the *Sovereign's* consumption averaged 8 cwt., and the *Meteor's* 5 cwt. of coals per hour, while the *Talbot* and the *Ivanhoe* used as much as 14 cwt. each in the same time.

In every other respect the *Sovereign* and *Meteor* proved themselves the best vessels on the line. From a Parliamentary return, the following particulars of the performances of the different packets for one year, namely, from June 1, 1821, to June 1, 1822, are extracted:

| Vessel. | No. of Passages. | Average passage to Howth. | Average passage to Holyhead. | Shortest passage to Howth. | Shortest passage to Holyhead. | Longest passage to Howth | Longest passage to Holyhead. |
|---|---|---|---|---|---|---|---|
| Royal Sovereign ...... | 143 | 7·39 | 7·2 | 5·48 | 6 | 16·4 | 12·50 |
| Meteor ............ | 147 | 8·16 | 7·17 | 6·15 | 5·30 | 17·20 | 23·10 |
| Talbot.............. | 16 | 9·24 | 8·2 | | No particulars. | | |
| Ivanhoe ............ | 6 | 11·57 | 6·53 | | Do. | | |
| Tartar ............. | 20 | 15·27 | 9·48 | | Do. | | |

*Note.*—The *Tartar* of 180 tons, and engines of 60 horses power, by Cook, of Glasgow, on the horizontal plan, was used by the Government as an experimental vessel; a Mr. Broderip being employed to make the machinery auxiliary to a sailing vessel, but without success. We find that in this year (the last of the sailing packets) they made in all 46 voyages, averaging 15 hours 2 minutes to Howth, and 14 hours 13 minutes to Holyhead.

In 1824, the *Sovereign* and *Meteor* were withdrawn from the station, and the *Aladdin*, *Cinderella*, and *Harlequin* put in their places. All these vessels were, I believe, built in London, and their engines from Boulton and Watts' factory. They were all nearly of the same dimensions; the tonnage of each was 234, and the power 80, afterwards, in 1831, increased to 100. The following are the dimensions, &c., of the *Cinderella*, built, in 1823, by Wigram:—

| | feet. | in. |
|---|---|---|
| Length over all .... | 119 | 9 |
| between perpendiculars....... | 116 | 6 |
| Extreme breadth .. | 37 | 10 |
| Depth............. | 12 | 6 |
| Diam. of cylinder.. | 35½ | 0 |
| Length of stroke .. | 3 | 6 |
| Diameter of wheel.. | 13 | 2 |
| Horses power ...... | 80 | |

Three other vessels, the *Escape*, *Wizard*, and *Dragon*, of the same class, were subsequently added. The Parliamentary returns state that the shortest voyage made by any of the vessels in 1830, was in 5 hours 26 minutes; and in 1831, 5 hours 14 minutes. The average of the quickest vessel, the *Harlequin*, previous to the alteration in her engines, was to Howth 7 hours 20 minutes; to Holyhead 6 hours 22 minutes; and the consumption of each, in 1826, is stated as above:—

| | cwt. | lbs. |
|---|---|---|
| Aladdin per hour...... | 14 | 68 |
| Cinderella ,, ...... | 11 | 94 |
| Harlequin ,, ...... | 11 | 42 |
| Escape ,, ...... | 11 | 55 |
| Wizard ,, ...... | 13 | 107 |
| Ivanhoe ,, ...... | 9 | 21 |

These vessels were in time superseded by others, but until 1848 no material change took place in the class employed; and the average time occupied in the passage, after Kingstown was substituted for Howth, in 1828, may be given as six hours. The establishment of another line of mail packets in this year, between Kingstown and Liverpool, materially interfered with the Holyhead traffic, and after the opening of the railway to Liverpool, in 1838, it almost ceased, although four boats still continued to ply.

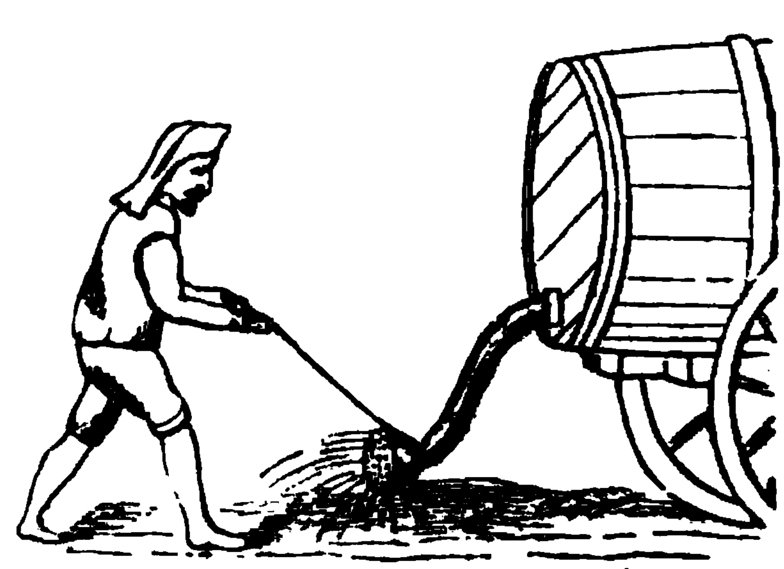
Such was the state of things until 1848, when the partial completion of the Chester and Holyhead Railway promised a restoration of much of the old traffic to its former route. The four obsolete Admiralty packets were transferred to other stations, and their places supplied by others of a class hitherto unknown. The Railway Company had obtained powers, though not until after a severe struggle, to run steam ships in connection with their trains, and had ordered the construction of four of a class fully equal to those of the Government. It is not my province to discuss—which has been already pretty fully done—the question of the propriety of the Government becoming competitors with a Company, who had already incurred such enormous liabilities in their endeavours to effect a truly national undertaking, and bring Dublin within an easy twelve hours' distance from the metropolis; I merely look upon the fact of eight steam ships, constructed by the most eminent builders and engineers in London and Liverpool, as a very interesting one, and which enables us to judge of the progress made in this department of science in these two places. The Admiralty vessels

were first in the field, and the earliest launched was the *Caradoc*, in the autumn of 1847. She was constructed of iron, by the late firm of Ditchburn and Mare, Blackwall, from the designs of Sir Wm. Symonds, and her engines on the direct-action principle by Seaward and Co. Her tonnage is 662, and her power 350. This vessel did not, on her trial trip in the Thames, realize the expectations formed of her, nor is she by any means among the best of the Holyhead boats. The next on the list is the *Banshee*, built of wood, chiefly mahogany, by Thompson, of Rotherhithe, and her engines (oscillating) by Penn. She, as before stated, was constructed from the designs of O. W. Lang. The *Banshee* has had several rivals: but I believe I may say that, for beauty, she is admitted by all to be unequalled. She was launched at the close of 1847, and in January, 1848, her trial trip took place. On that occasion her performances exceeded anything before realized, her average speed being 18¼ statute miles per hour; with wind and tide she went 21 miles per hour, and against ditto 18, or the measured mile in 3 m. 15 sec. and 4 m. 20 sec. respectively. The *St. Columba*, of iron, by Laird, of Birkenhead, and engines by Forester, of Liverpool, was next ready for sea; and the Holyhead Railway not being as yet open, she, with the *Banshee*, were placed in March for a short time on the line between Kingstown and Birkenhead. A trial trip took place early in this month between the two vessels, when, in the run from Liverpool to Kingstown, the *Banshee* beat her competitor by one hour exactly. On one occasion the *Banshee* made the passage, 130 miles, in 7 h. 7 m.; and when employed, in the summer of 1848, to convey Lord John Russell to Glasgow, she made the run from Kingstown in 12 hours—a remarkable performance. Wise people, however, shook their heads, and said—"Wait till the winter comes, and see how she and the others will behave." The winter came, and with it many a hard gale, but the *Banshee* behaved right well, if not the best of all; and in the present month (April) she is running without any diminution of speed, and apparently none the worse for the hard work she has gone through. The *Llewellyn*, of iron, with oscillating engines, by the same parties who built her—Miller and Ravenhill, of Blackwall—came upon the station in August, 1848, when the Holyhead Railway was opened. Great expectations were formed of her, nor were they altogether unfulfilled. On her trial trip, she averaged 17·89 miles per hour, and her subsequent performances rank her next to the *Banshee*. But a writer in the *Morning Herald*—the same, I believe, who acts in a similar capacity in the *United Service Gazette*—in his notices of steam navigation, has endeavoured to exalt this vessel at the expense of the rest, and his wrath is greatly excited at any who should dare to question her superiority. It is to be hoped the eminent firm who constructed her have no knowledge of the individual alluded to, who takes upon himself to write puffs of their engineering skill, in a strain occasionally the most offensive.

(*To be continued.*)

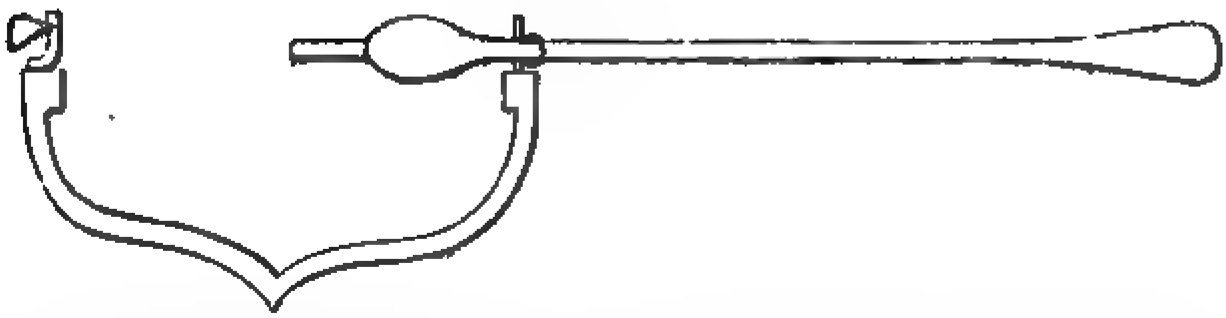
GLEANINGS OF A TRAVELLER.

Sir,—I observed at Malta a mode of watering the streets which I think might be used for the same purpose, and various others, in England. A leather hose is fixed into a water-barrel carried in a cart; the other end is furnished with a perforated *rose*, and a man, by swinging this to and fro with a string, distributes the water over any particular part he may desire. Perhaps the various liquid manures could be spread in this way, or the plan be found useful in small towns, gardens, or avenues, where watering is seldom required, and where the facility with which the apparatus can be disengaged from the simple cask to which it is attached, would be an object.



In fig. 2 is represented the form of the oars used in the swift and graceful

Fig. 2.



caiques on the Bosphorus; and I cannot help thinking that our "Newell's" and "Clasper's" might adopt the well-balanced paddle which is used by the Turks at Constantinople with very great advantage. The use of a single thowel-pin and a leather thong for a sling is universal in the east, and the superiority it possesses over the double thowel-pin is, in my opinion, very great.

There is a useful and economical plan for giving a supply of drinking water to the traveller, which I have noticed, I think at Damascus, and elsewhere in Syria. A tube reaching down to a suitable reservoir, has its upper extremity fixed in a wall, and furnished with a mouth-piece. By applying the mouth to this, any amount of water can be raised from below by suction; and as the water cannot be used except by the mouth, an effectual security is afforded against wilful or accidental waste. I shall mention here a phenomenon—not because it is observed for the first time, but because it has suggested to me what I have not seen in any work relating to the subject. When I visited the Pyramids, a violent gale of wind blew with great force over the desert. Those whom I found at the foot of these structures, said that it was not a proper day for the ascent on account of this hurricane. However, when I arrived at the summit of Cheops, the air was nearly a perfect calm. Now the explanation of this readily presents itself; for the immense area of inclined surface of the side of the pyramid no doubt deflected the wind upwards, and this was farther shown by the upward flight of various pieces of paper and other light substances. But the same effect must be produced when wind blows over the inclined side of a mountain, and if so will cause a very considerably reduced atmospheric pressure to be registered at the summit. The altitude of a mountain then, deduced from barometric observations, must be liable to an error of great importance whenever a breeze blows from any point upon the hill.

At the risk of making this communication even more heterogeneous than it is already, I shall describe an Egyptian potter whom I saw at Keneh, near Thebes, a place justly famed for its porous jars and other articles of earthenware. The wheel was heavily loaded, and turned directly without the intervention of a crank, by frequent impulses given to its plane surface by the foot. In order to have his two hands free for the work, the man had suspended his pipe from a beam above him.

The jars are left one day to dry, and

are then turned a second time on the wheel, and brought finally to the thinness of a wafer. The water exudes freely through the sides, but a piece of harder clay is inserted, to prevent leakage at the bottom. The jars are nearly of the shape of a Florence flask, and the rapid evaporation promoted by the constant filtration through them of the water, imparts to it a delicious coolness.

I am, Sir, yours, &c.,

JOHN MAC GREGOR.

Thebes, Upper Egypt, Jan. 24, 1850.

## A WELL-VENTILATED HOUSE.

Sir,—Agreeable to my promise, I now send you a short account of the method by which I have procured an ample supply of fresh air, without currents of cold air across the room, and also the instantaneous removal of all impure air. As every room in my house is ventilated on the same plan, with, of course, slight adaptations to circumstances, it will be sufficient to describe the method used in the room in which I am now writing.

The fresh air is admitted through an air-brick, placed, as will be perceived from the accompanying plan (fig. 1), and sectional elevation on the line B (fig. 2), a little below the level of the floor; it

Fig. 1.

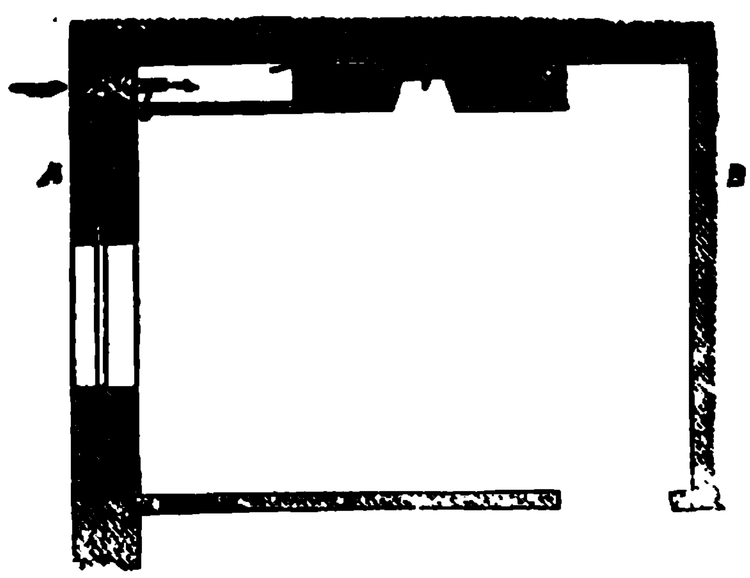
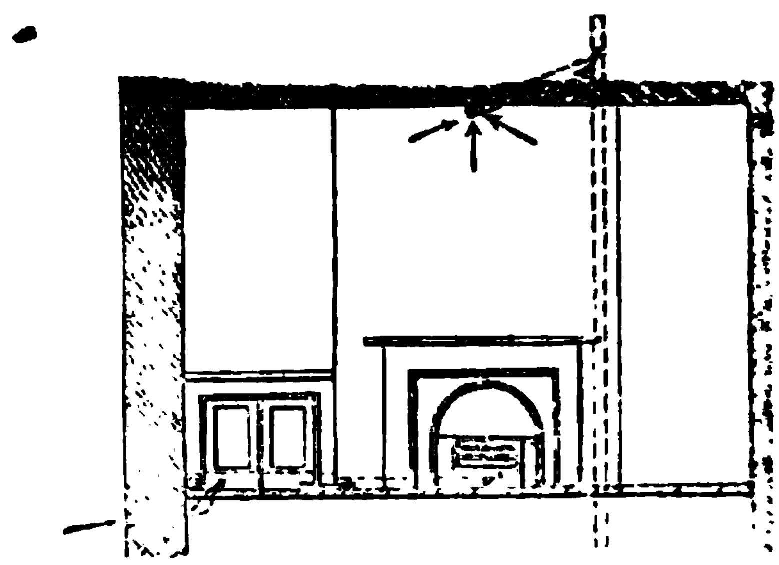



Fig. 2.



passes upward through a zinc tube into a space five inches high between the floor and the false bottom of a dwarf closet, then through an opening four inches square in the brickwork of the jamb, and enters the room under the grate. There is also an entrance for it through a piece of perforated zinc inserted in part of the closet door; but this may be shut up, if desired, by a slide inside the closet. Where there is a flue in the jamb next the outer wall, the opening from the closet to the fireplace is made between the skirting-board and the brickwork; and this also acts very well, though the channel is not so large: but as this adaptation has only been required in bedrooms in which there is seldom a fire, I cannot give so decided an opinion. In these, however, the entrance in the post of the closet door is of the greatest importance, and answers my most sanguine expectations.

An ash-pan, with a low back and high front, prevents the ashes from being blown over the room, and also turns the current of air up through the fire. I need scarcely add that the fire burns brightly, and that we have no smoky rooms.

The heated air escapes by an opening within two inches of the ceiling into a tube formed of two-inch drain pipe, built into an angle of the flue, and reaching from the level of the ceiling of the lowest room to the chimney top. The connecting tube is made of zinc, and the opening into the room covered with a perforated piece of the same metal.

Instead of detailing the experiments I have made to prove the efficiency of this mode of ventilation, I shall merely state that this room is about 13 feet long, 10 feet broad, and 6 feet high, and that with a good fire of coke or coal, a strong gas-light, and eight persons in the room during four hours, we have not felt the slightest inconvenience from currents of cold air, nor the least closeness in the atmosphere of the room. When gas is allowed to escape in any of the rooms, in a few minutes after it is stopped, all smell vanishes.

Feeling sincerely grateful to my builders, the Messrs. Wells, of Chatham, for the great attention they paid in carrying out my views and suggesting practical improvements on them, and highly pleased, after nearly four months' trial, with the result of the experiment, should you think a notice of it in your widely-circulated Magazine would be of any public benefit, or would be at all likely to induce others to make even small rooms comfortable and healthy, I feel it my duty to permit you to make any use of this letter that you please.

I am, Sir, yours, &c.,
WILLIAM BURNS.

Newton-terrace, Rochester,
April 6, 1850.

THE EFFECTS OF MACHINERY ON THE WELFARE OF THE LABOURING CLASSES.

Sir,—In a magazine which, more than any other, has contributed to the improvement of all kinds of machinery for the last quarter of a century, an attempt to examine into the consequences of such improvements on the interests of the labouring classes can hardly be considered out of place.

It is well known that very opposite opinions have been held on this subject, and are still held by various parties. Amongst the working class, the prevalent impression is, that all new inventions in machinery, and all improvements in the old, are highly injurious to their interests, whilst they are beneficial to their employers. On the other hand, most of the authorities on political economy, though they allow that "temporary inconvenience may be occasioned by sudden alterations in the channels of trade," &c., &c., stenuously contend that *ultimately* all these improvements and new inventions are beneficial to the operatives as well as to their employers, the capitalists. There is another class of writers, however—of the well-meaning sentimental, "Young England" school, who join with the labourers in anathematising machinery; who sigh for the days "when England was *merry* England," when,

"Merrily went the click-clack, the hammer, and the plough,
And honest men could live by the sweat of their brow."

They look on the steam-engine as a diabolical and cursed invention, the power-loom as a most ungodly and cruel instrument; and instead thereof would invoke back the aforesaid "click-clack," whatever that might be. If bringing back this "click-clack" would make all England "merry" again, by all means let us have it as fast as possible. If Lord John Manners is a conscientious man, he will let us have a specimen of it at the forthcoming "Exhibition of 1851." Meanwhile, let us inquire into the real state of the machinery question, fully and carefully.

Now, in the first place, all parties are agreed that the introduction of machinery to do the work of human hands will necessarily have the effect of throwing some of these hands out of employment *for a time*, longer or shorter, according to circumstances. This may not happen in absolutely *every* case. It is conceivable that, under some circumstances, the introduction of machinery may not render any of the hands previously employed needless or superfluous. Thus a farmer, on introducing a thrashing machine, may not dismiss a single labourer, but employ the thrashers in some other way; and similar in certain manufactures. But these cases are very few, and do not require any consideration, however numerous they might be. We start, then, with the supposition that some hands are rendered needless by the new machinery, at least, to begin with.

The next thing to be considered is, that the machinery will lessen the cost of the article manufactured. It will either produce a much greater amount of goods at the same cost as before, or the same amount at a less cost. This is the very object for which it was introduced. Hence, one argument that has been used to show that machinery does not diminish the demand for labour; viz., the argument that the machinery will require as much human labour to make and keep it in order as was employed before its introduction, is absurd. For if as much labour were required *with* the machinery as *without* it, the manufacture would become more costly and expensive than before, instead of less so; and the manufacturer would lose instead of gain by introducing it.

The "*cost of production*" being thus lessened by the machinery, we have next

to inquire, *who reaps the benefit?* Now, two or three cases are possible here. In the first place, the machines may be patented; one manufacturer may have the exclusive use of it. In this case, two courses are open to him. He may either go on selling his goods at the same rate as before, and pocket the sum saved by the machinery; or he may lower the price, in hopes of a larger sale. If he adopts the first plan, the result of the introduction of the machines will simply be to throw some hands out of work, and to put the amount thus saved (*i.e.* the amount of their wages) into the pocket of their employer. But trace this one step further;—what will he do with the saving? If he adds it to the capital already employed in his own trade, he may produce more largely than before, and take back some of the hands which had been dismissed. But he cannot take them *all* back; at least, at the former rate of wages; for to do this would require, not only that the increased produce should find a market, but that his capital be increased by borrowing, or some external means. For, it must be recollected, that part of his capital is now *sunk* in the machinery; so far, then, there must still be *some* hands thrown out of employment. But, instead of employing the sum saved in wages in this way, he may simply send it to his bankers, who will lend it to other manufacturers, it may be, and they may thereby be induced to extend *their* production (if markets can be found), and the extra demand for labour thus created in their branch of trade may absorb part, or the whole of the hands thrown out from the first manufacture.

Let us return now to the second course open to the manufacturer (whom, for the sake of brevity, we shall call M).

We have hitherto supposed that he has not lowered the price of his goods. But, generally speaking, the hope of a larger sale will induce him to do this. In this case—if a market exist for this larger sale, and *if* the increased supply cannot be furnished by the machine without an increased number of hands, then some of the discarded hands will be recalled.

Throughout the whole investigation, however, we have one thing constantly staring us in the face, namely, *how far a lower price will induce a larger sale?* And there are one or two considerations on this point which, though obvious and plain enough, one would imagine, are nevertheless often overlooked by writers on the subject. The first consideration is, that the sale of all goods is necessarily limited by the power or ability of the public to purchase, and as every individual has only a certain income to spend, if he expends more of this income on some articles, he must spend less on others; if he spends more on articles of cotton manufacture, he will have just so much less to spend on all other manufactures, &c. Hence it follows that *all branches of manufacture cannot be extending their sales at the same time,* unless, indeed, by what amounts to exchanging their goods with each other. Suppose M and N are the only manufacturers, and I am the only purchaser in the would. If I have a hundred a year to spend in manufactures, if I spend more on M's goods, I have just so much less to spend on the purchase of N's goods. The extent of their sales is limited by the extent of my ability to purchase. But M and N may go on increasing their productions indefinitely, if they choose to exchange their goods with each other; each is a market for the other. And this is the whole history and mystery of that much controverted question about the possibility of "a general glut."

And, in considering this question, about the possibility of finding markets for an increasing amount of manufactured goods, or the possibility, on the other hand, of "over-production," or "a general glut," as it has been termed,—our subject has led us to an almost boundless field of inquiry. It is necessary to the settling of our primary question that we should glance at the new subject thus presented, however,—because the one depends on the other. The hands dismissed from one branch of manufacture wherein machinery has taken their place, can only find employment in other branches, on condition that these other branches can be extended, or be recalled to their own former occupation on the condition of this branch being extended. If there be a limit to the quantity of goods that can be sold at a remunerating price, then there is also a limit, of course, to the number of workmen that can be employed in the

manufacture of these goods. Now many political economists, while allowing the possibility of such a limit in any one particular branch, or in more than one, deny the possibility of such a limit to *all* branches of manufacture. And the whole of their argument amounts simply to this:—Let M, and N, and P, and Q, be four manufacturers, and Z the public in general. Then, though Z may only be able to spend a certain amount on the goods of M, which would therefore be the limit to M's possible sales, and similarly for the other three, yet the four manufacturers may go on producing *ad infinitum*, and finding customers in each other. The very fact of M's producing articles for sale, say they, shows that he wants something in return—some new comfort, or necessary, or luxury which N, and P, and Q, can supply. And this argument holds good so far as all manufactures, which can be increased indefinitely by mere human exertion, are concerned. So far as these go, there is no limit to the market for the goods produced, and consequently, the labour employed. But there is another element to be taken into account which will soon alter the case, and limit this unbounded production. And this is the agricultural capabilities of the earth. If the manufacturers and their operatives could live without food, and the raw materials of their manufacture could be supplied indefinitely (which may, practically, be considered to be the case), then there would be absolutely no limit to their industry, no limit to the amount of their productions, no want of market for their disposal, for M, N, P, and Q might always exchange their surplus produce with each other. The cotton manufacturer might barter his cotton as fast as produced, for the productions of the woollen, silk, hardware, and other manufactures. But the agriculturist cannot go on indefinitely increasing *his* produce, and so he limits or stops short all the rest. The more the manufacturer works, the more he gets of their produce, but he gives them no more of his corn than before, except within very narrow limits. There can never be a *glut* of manufactured goods *as compared with* each other, for every manufacturer has it in his power to exchange his surplus against the surplus of other manufacturers. But there may be a *glut* of all manufactured articles as compared with the farmers' produce, simply because the latter cannot be made to increase as fast as the other.

Let us now see how the matter stands in point of fact. Our farmers can only raise food at a certain price—this price renders a certain rate of wages necessary to the manufacturer's operatives, and this again renders a certain price necessary for the employer to put on his goods; and this price limits the extent of his sales. The degree in which the price of food affects the manufacture will depend on the proportion in which *wages* enter into the cost of the production of his goods. If he employs no machinery, and everything is done by hand—that is, if wages are the only item in his trade-expenses—everything will depend on this price of food. If, on the other hand, he could do without hands at all, and his machinery could do everything, nothing would depend on this price of food. He could, on this last supposition, when once in possession of his machinery, undertake to sell his goods for ever, without any reference to the price of food. So far as the cost of production is concerned, the price of goods will depend on that of food, according to the proportion in which the two elements, viz., wages and machinery, enter into that cost. Of course the *sale* of the goods, the amount or extent of the market, will depend on the price of food, inasmuch as people who had to spend all their income on food would have nothing to spend on manufactures. Whatever, therefore, increases the amount of food in the world, or lessens the cost of its production, increases the market for manufactured goods. And, in some cases, the very presentation of such goods, the offer of them for sale has the effect of increasing the amount of food. For instance, in the barbarous and uncultivated parts of the world, the inhabitants may be stimulated to increased cultivation of their land, by the desire to get our goods. And when our merchants discover a new market abroad for our goods—this new opening may either be of this kind, namely, an increased supply of food in those regions, raised in order to pay for our manufactures, or it may be merely that we receive some of *their* manufactures in exchange for ours. This last kind of new opening

or foreign market will not support any more of our manufacturing population than before: the first will. The one will, in fact, simply have the effect of giving us some foreign articles in exchange for some of our English articles. The other will bring fresh food to our shores, which will support an increased population in any way we please, or support the present population in a more comfortable state.

There is a limit to agricultural cultivation, both here and abroad, arising from the simple circumstance, that no land can be cultivated which does not at least support those who cultivate it. If it does support its cultivators, and moreover yields more food than they want, the surplus can be exchanged for clothes, and other comforts and luxuries. And rents and farmer's profits, which come out of this surplus, are so exchanged; and what the labourer gets more than enough to feed him, which makes up the remainder of the whole surplus, is also thus exchanged. The manufacturing population (together with the rest of the non-agricultural) get the whole of this surplus food in exchange for what *they* produce, or for their services in some form or other. With these preliminary views, we may now return to our immediate subject.

A. H.*

(*To be continued.*)

### ON SECONDARY EMPLOYMENT FOR OPERATIVES.

Sir,—Encouraged by the impartiality with which you admit discussion in your pages, and by the wish your correspondent, "A. H.," has expressed that your Magazine should "devote a portion of its columns to a careful and cautious investigation of this intricate subject," namely, the best means of combining the interest of operatives with that of their employers, I again refer to the plans and practice of Sir Samuel Bentham, as conducive to a further investigation of this important matter. The candour and liberality evinced in your correspondent "A. H.'s" paper, indicate that his turn of mind renders him particularly competent to pursue inquiries of this nature, and which, as he says, are of "such vital importance to thousands" (rather millions) "of our fellow countrymen;" and should this communication be the humble means of drawing forth his farther observations on the subject, it will be as gratifying to me as it promises to be beneficial to those millions. I cannot be insensible to "A. H.'s" candour, nor to the complimentary terms in which he speaks of my papers: but whatever merit they may possess, it is attributable solely to Sir Samuel Bentham. Hitherto he has appeared in the *Mechanics' Magazine* as little other than a mechanician, a naval architect, or an engineer; but the range of his mind extended also to subjects of political economy,—amongst others, to those bearing on a combination of the interest of the employed with that of their employers. This may be seen in his plans for the better management of civil naval concerns; for whilst they promised the saving of millions in our annual expenditure, they provided for the well-being of the operatives employed in the naval department. Those plans cannot be regarded as visionary, since they were fully appreciated by those distinguished naval administrators, Earls Spencer and St. Vincent, and many of these plans were carried into effect by their lordships: all of them would have been adopted but for subsequent changes of administration. If this be brought forward on the present occasion, it is for the purpose of exciting confidence in his recommendations.

Sir Samuel did happen to possess the two distinct qualifications which "A. H." points out as essential to the development of social and political science. He had, "in the first place, an extended and accurate acquaintance with *facts*." This acquaintance was acquired by a nine years' observation of them in the several royal dockyards; then of facts in Holland and other European countries, followed up by three years' investigation of the management and working of Russian mines, and manufactories of metals both in European Russia and in Asia, from Archangel southward to the confines of China, and along them eastward. He had afterwards the management of the works of the Fontarabia Canal; then, as a friend of Prince Potemkin, he

* In my last communication (page 305, col. 2, line 12,) for "difficult," read "different."

undertook the re-organization of the prince's immense manufactories near Cricheft, consisting of iron, steel, copper, and mixed metal works, a rope-walk, a sail-cloth fabric, a malt-house and beer brewery, a distillery, and two glass-houses. He had the selection of work-people from amongst the forty thousand male vassals on the prince's estate; he had, besides these, his battalion of 1,200 men, none of whom had ever seen a ship, and but few of them could even use an axe; yet he converted a great number of them into shipwrights and navigators. Variety enough to give any man of observation an intimate knowledge of *facts*. On his return to England he made himself acquainted with the details of a great number of English manufactories; and again, previous to his establishing the three manufactories in Portsmouth Dock-yard, he made another tour of investigation amongst English manufactories, the books of several of which were laid open to him. His energies were not confined to questions of profit and loss; they extended to the habits, the health, the comfort, and the morals of the operatives; and a great diversity he found in these respects. In some manufactories, as at Sheffield, he noticed the reckless employment of little children for fourteen hours of the twenty-four, in close, unventilated, offensive shops,—the boys' filthy flesh often in many parts uncovered by their ragged clothing. At Warrington, he found sail-cloth weavers a dissipated set; their earnings in two or three days enabled them to spend the remainder of the week intoxicated in a pothouse, whilst master-manufacturers, in hopes of bribing their people to work, affixed to many looms a notice that a shilling extra would be given for every piece of canvass made in a week beyond a certain number, that number being what three days' work could complete. In some cotton factories he saw the operatives pale and emaciated from excess of heat, in others from working all the night and sleeping all the day. On the other hand, he observed, with infinite satisfaction, in several manufactories, that the operatives were healthy, happy, and flourishing, under enlightened and considerate treatment—as at the Messrs. Strutts, at Belper. These gentlemen had already erected for their operatives five hundred houses, airy, light, and cheerful, with a broad paved terrace in front, as playground for their children; and many were the devices and arrangements for enabling the people's wages to procure them comforts, and save their cash; and there was neither lawyer nor pothouse in the place. Belper afforded an example of the ease with which proprietors can, in a manner, ensure the well-being of operatives living in their own homes. As an instance of the good effects of judicious arrangement where in-door apprentices are employed, the flax-mills of Mr. Bage, in North Wales, may be cited. His machinery was tended by young persons, apprentices, from fourteen to eighteen years of age; they were, every individual of them, remarkable for robust health and strength: the joyous countenances of these young women excited particular attention, as did the neatness and propriety of their dress; it was the usual costume of their country—a sort of loose jacket, of a strong material, with a striped woollen petticoat and neat cap; but Mr. Bage, amongst other indulgences, allowed the Sunday printed gown to be of their own choice from amongst the draper's store. When not at the machines, these girls were under a matron's care; they had an evening school, and received religious instruction from the minister of the parish. Their diet was, as to quantity, unlimited, and included a due quantity of butcher meat; yet it was said to cost no more than sixpence a day. This seemed incredible; the books were produced, minutely examined, and the average found to be within that sum.

Thus it was that he familiarized himself with *facts*; his comprehensive and logical mind gave the "ability to examine and draw sound conclusions from them." It was from the "accumulation of facts carefully made and recorded," that he came to the arrangement of that system of relays exhibited in your Magazine,* and in the *Morning Chronicle* of 4th February last. No one specific objection seems hitherto to have been brought against these relays, modified, as they ought to be, according to the circumstances attendant on each particular class of manufactures. The word *relay* having now, however, acquired an ill name—and much is in a name—better that recurrence should again be had

* Numbers 1314, 1389.

to his own denomination—different *sets* of operatives; and under this name it seems desirable that the system should be discussed. Should disadvantages present themselves as attendant on it, the stating them fairly and specifically, will be doing a real service to the community. Should they be valid, there will end the project; but if, on the contrary, those objections should prove groundless, or, even if valid, but outweighed by other advantages, these preponderating advantages would justify a trial of the measure.

The working a double set of hands beneficially to both the employer and the employed depends materially on a *secondary* employment for the operatives; it therefore seems much to be wished that your correspondent, "A. H." would devote his talents to an investigation of the subject. Sir Samuel continued to the last, convinced of the service that would be done to the labouring classes, by habituating them to two different means of earning their daily bread; but the only example of it in this country, on an extensive scale, seems to be in the instance of our *female* population. Most girls of all ranks are taught to sew, though rarely as the chief means of earning a livelihood, excepting in the few instances of skilled milliners and dress-makers; yet how many thousands fall back on needlework as a resource when other employments fail. Some few females of superior classes eke out a scanty income by the finer works of the needle; but countless is the number of girls and women who fall back upon plain or coarse needlework when service or other employment is not to be obtained. Poor, indeed, is the remuneration that needlework obtains, yet there seem good grounds for the supposition that even this sad resource keeps many a woman from crime; it has lately been stated that thirty women committed to the Millbank Prison were incapable of doing plain needlework, and persons much interested in the Pentonville Prison, not long ago asserted that very few of the females committed to it could do the coarsest needlework.

The Royal Dockyards afford an example to a small extent of artificers skilled in two different handicrafts; shipwrights called double-handed men, that is, who can caulk a ship as well as put its parts together. Sir Samuel proposed that caulkers, as a separate class of artificers, should be abolished, and all shipwrights become double-handed; an innovation particularly desirable, the demand for caulkers' work being extremely variable; of late years, the proportion of separate caulkers has been too great, so that, superior as they are to the business of a common labourer, they often idle about unable to turn their hands to other work.

Switzerland affords an example on an extensive scale of secondary employment for man. A great proportion of the people, whose chief support is husbandry, are also carvers of wood; some of their bowls and platters coarse and rude enough, but many men attain great skill in the art of carving, and sell the beautiful produce of their winter-evenings' work for considerable sums. The Swiss are proverbially, a happy, independent, free, moral, and religious people, yet no one seems to have noticed the effect which this habitual secondary employment may have had upon them.

In none of these instances does it appear that the secondary employment diminishes skill in the principal one. A household servant is thought to be none the worse in her principal business because she is an expert needlewoman; it is the best shipwrights usually who are double-handed men; and in the great metal works and mines in Russia, the people employed in castings and other works are not believed to have their manufacturing powers diminished by the six weeks' holiday they are annually allowed to make their hay, &c.; the privates of his own battalion, that Sir Samuel made shipwrights of at Cricheft, lost not thereby their fitness for soldiers; so, also, many other instances might be adduced of the aptitude of man to acquire and practise two different means of earning bread without inferiority in either of them. M. S. B.

(*To be continued.*)

## RECENT AMERICAN PATENTS.

(Selected from the Reports in the *Franklin Journal.*)

For an Improvement in the Consumption of Fuel in Steam Boiler and other Furnaces. *Christian Burckhardt.*

This invention consists in applying decomposed steam, at a high temperature, to the products of combustion above the coal or other fuel, together with a due proportion of atmospheric air, the whole of which com-

mingle, and by which all the combustible matter in the fuel is consumed.

*Claim.*—The employment, arrangement, and combination of apparatus for consuming the gases arising from ignited fuel, by the introduction of decomposed steam, or the gases resulting therefrom, and atmospheric air in a highly heated state, over fire.

FOR IMPROVEMENTS IN TRUCKS FOR RAILROAD CARS. *Isaac Knight.*

*Claim.*—The connecting and combining, in the carriage for carrying burthens and passengers upon railroads, one or more intermediate pair of cylindrical wheels, or wheels nearly cylindrical, without flanches, loose upon their axles, or otherwise independent in their action, so that any one of these intermediate wheels may revolve faster or slower than the others, in connection with guide wheels having one or two flanches, they being made fast to their axles; and also, either for a six or eight wheel car, all the wheels of the same carriage, both fast and loose on their axles, being attached to one and the same stiff frame by means of springs and bearing boxes or otherwise.

FOR AN IMPROVED METHOD OF LIFTING VESSELS OVER SHOALS. *Abraham Lincoln.*

*Claim.* — A combination of expansible buoyant chambers, placed at the sides of a vessel, with the main shaft or shafts, by means of the sliding spars or shafts, which pass down through the buoyant chambers, and are made fast to their bottoms, and the series of ropes and pulleys, or their equivalents, in such a manner that, by turning the main shaft or shafts in one direction, the buoyant chambers will be forced downwards into the water, and at the same time expanded and filled with air, for buoying up the vessel by the displacement of water; and by turning the shaft in an opposite direction, the buoyant chambers will be contracted into a small space and secured against injury.

FOR AN IMPROVED METHOD OF ATTACHING THE TANG TO THE HANDLE OF TABLE CUTLERY. *David N. Ropes.*

*Claim.*—A mode of constructing and combining, or fixing together, the handle and tang of the blade of a knife or piece of cutlery, the same consisting in making the said tang with one or more stationary studs or projections, in combination with making the main tang passage of the handle with lateral and transverse passages for the entrance and reception of the said projection or projections during the process of cementing, all substantially as specified; the handle, by such means, being firmly secured to the blade or tang thereof, and so as to permit no appearance of any rivet on its external surface.

FOR AN IMPROVEMENT IN HOT-AIR REGISTERS. *Charles F. Tuttle.*

The patentee says,—"The nature of my invention consists in the new and improved method adopted in opening and closing the register ventilator, by means of an upright or vertical wheel, or a segment of a wheel, which is connected with, and gives motion to, the valves, by means of a moveable connecting-rod, which is suspended on the side of the wheel on a pin projecting therefrom; and this connecting-rod is attached to the valves by pins at their ends."

*Claim.*—The upright or vertical wheel, or part or segment of a wheel, to the opening and closing of hot-air registers and ventilators, the edge or periphery of which is placed flush, or nearly so, with the top surface of the register, and can be acted upon by the foot if desired; the wheel, or part of a wheel, so placed imparting motion to the valves through a connecting-rod or rods, which are connected or attached to the wheel at a point distant from its axis, and to the valves by pins at a distance from their centres of motion; the connecting-rod or rods moving in a circular direction with, and corresponding to, the motion of the valves that are moved.

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*The Electro-Chemical Telegraph.* — An experiment was made on Thursday at the Elysée, by order of the President of the Republic, of the electro-chemical telegraph of Mr. Bain. The telegraph was fixed up in the grand saloon of the Palace, and soon after one o'clock the experiments commenced. Mr. Bain, the inventor, was accompanied by Mr. MacDougall, by Mr Wilkinshaw, and by Dr. Lardner. The President was attended by the Minister of the Interior, his *chef du cabinet*, and M. Chevalier, Secretary-General of the Presidency. M. de Persigny, the French Ambassador to the Court of Berlin, was also present. M. Leverrier, of the Institute, who has taken great interest in the invention of Mr. Bain, and who was present on Thursday at the Ministry of the Interior, when the telegraph conveyed a long despatch to Lille and back, a distance of 325 English miles, in less than one minute, explained the process to the President of the Republic. The Prince comprehended rapidly the principle and the mode of execution, which, he said, were almost marvellous, and complimented Mr. Bain on the labour and intelligence which he had displayed in bringing his invention to such perfection. As an instance of the extraordinary powers of this telegraph, we may mention that, in the presence of the President of the Republic, a despatch, containing 1,327 letters, was conveyed in the space of 55 seconds, being at the rate of nearly 1,500 letters per minute.—*Galignani's Messenger.*

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## LIST OF SCOTCH PATENTS FROM 22ND OF MARCH TO 22ND OF APRIL, 1850.

James Higgins, of Salford, Lancaster, machine maker, and Thomas Scholefield, Whitworth, of Salford, aforesaid, mechanic, for improvements in machinery for preparing, spinning, and doubling cotton, wool, flax, silk, and similar fibrous materials. Sealed, March 22; six months.

François Vouillon, of Princes-street, Hanover-square, Middlesex, manufacturer, for improvements in the manufacture of hats, caps, bonnets, and other articles made of the same or similar materials. March 26; six months.

William Edward Newton, 66, Chancery-lane, Middlesex, civil engineer, for improvements in the

manufacture of knobs for doors, articles of furniture, or other purposes, and in connecting metallic attachments to articles made of glass, or other analogous materials. (Communication.) March 26; six months.

Jonathan Charles Goodall, of Great College-street, Camden-town, Middlesex, card-maker, for improvements in machinery for cutting paper. March 27; six months.

Charles Felton Kirkman, of Argyle-street Middlesex, gentleman, for improvements in machinery for spinning or twisting cotton, wool, or other fibrous substances. March 28; six months.

Robert Milligan, of Harden, near Bingley, York, manufacturer, for an improved mode of treating certain floated warp or weft, or both, for the purpose of producing ornamental fabrics. March 28; four months.

Robert White and James Henderson Grant, both of Dalmarnock-road, Glasgow, North Britain, engineers, for certain improvements in machinery or apparatus to be used in mines, which improvements, or parts thereof, are also applicable to other purposes of a similar nature. April 11; six months.

William Mac Lardy, of Manchester, Lancaster, gentleman, for certain improvements in machinery or apparatus for preparing and spinning cotton and other fibrous substances. April 15; six months.

John Scoffern, of Essex-street, Middlesex, M. B., for improvements in the manufacture and refining of sugar, and in the treatment and use of matters obtained in such manufacture, and in the construction of valves used in such and other manufacture. April 17; six months.

James Buck Wilson, of St. Helens, Lancaster, rope maker, for improvements in wire ropes. April 22; six months.

## LIST OF IRISH PATENTS FROM 21ST OF MARCH TO 19TH OF APRIL, 1850.

John Fowler, junior, of Melksham, Wilts, engineer, for improvements in draining land. April 17.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

William Gilbert Elliott, of Blisworth, Northampton, gentleman, for improvements in the manufacture of bricks, tiles, and pipes, and other articles from plastic materials. (Being a communication.) April 27; six months.

Charles May, of Ipswich, engineer, and Robert Leggett, of the same place, foreman of mechanics to Messrs. Ransom and May, of the same place, for improvements in machinery for threshing and grinding corn, for cutting straw, and other similar substances; also improvements in applying steam power to give motion to such classes of machinery; and also improvements in machines for depositing seed. April 30; six months.

George Michiels, of London, gentleman, for improvements in treating coal and in the manufacture of gas, and also in apparatus for burning gas. (Being a communication.) April 30; six months.

Evan Protheroe, of Austin-friars, London, merchant, for improvements in the manufacture of oxide of zinc, and in making paints from oxide of zinc. (Being a communication.) April 30; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| April 26 | 2284 | James Cuthbert & Co. | Great Distaff-lane, London | Apparatus for mulling liquids. |
| 27 | 2285 | Charles Starkey | Bloxwich | Lock. |
| 29 | 2286 | Hardman, Norton, and Co. | Gresham-street, London | Attacher for coats and other garments. |
| ,, | 2287 | Rowland Fothergill | Aberdare Iron-works, Glamorgan | Sleeper for tram plates. |
| ,, | 2288 | Joseph Peace | Sheffield | Saw handle. |
| 30 | 2289 | Joseph Chatwin | Birmingham | Albert gas-burner. |
| ,, | 2290 | Hall and Wilson | Manchester | Gas retort. |
| ,, | 2291 | Edward Thomas Loseby | Gerrard-street, Islington | Portable crane shower bath. |
| ,, | 2292 | Shoolbred and Loveridge | Wolverhampton | Hip bath. |
| ,, | 2293 | Robert Barsby & William Wells | Dudley | Day indicator. |
| ,, | 2294 | Samuel Daniel | Birmingham | Looking-glass movement. |
| May 2 | 2295 | Francis Pike Hewitt | Nottingham | Compound elastic band, or strap, for articles of dress. |

## CONTENTS OF THIS NUMBER.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1396.] SATURDAY, MAY 11, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## ALLIOTT'S APPARATUS FOR REGISTERING THE VELOCITY AND STATION TIME OF RAILWAY CARRIAGES.

Fig. 4. Fig. 5.

ALLIOTT'S PATENT APPARATUS FOR REGISTERING THE VELOCITY AND STATION TIME RAILWAY CARRIAGES.—(SEE VOL. L., P. 381.)

*Specification.*

MY improvements in apparatus for ascertaining and registering the velocity of carriages are represented in fig. 1 (an elevation chiefly in section), and in fig. 2 (a plan). A is a cylinder mounted upon a spindle $A^1$, and turning in bearings $A^2$, $A^2$; BB, are two conical vessels which are securely attached to the cylindar A, by arms, $B^1$ B ; DD, are small pipes which connect the cones BB with the cylinder, and terminate in the lowest part of the cones as represented; C is a diaphragm, which is jointed upon the cylinder by means of the flange of the frame EE; F is a hollow plunger which rests upon the diaphragm, and is retained in its position and guided by friction pulleys $E^1E^1$ ; H is a rod, with a rack formed on one side of it, the lower end of which rod is kept in the step, $h^1$, by the helical spring, G; this rod is kept free to slide up and down through a square hole or bearing, formed in a cross piece T, and by which it is prevented from turning round. The rack H gears into a pinion *k*, and gives motion to the wheel L, which again works the rack *a*, and registering pencil. N is a drum for carrying the registering paper. Motion is communicated to the spindle $A^1$, and to the drum L, fig. 1, from the axle of the carriage, by means of pulleys of sizes calculated to produce the requisite speeds. To prepare this apparatus for work, the cylinder A must be filled with water till the diaphragm C becomes distended. When the machine, as thus prepared, is set in motion by connection with the axle or wheel of the carriage, the water in the cylinder is driven by the centrifugal force into the conical vessels BB, and compresses the air contained therein. As the water sinks in the cylinder by flowing into the conical vessels, the diaphragm C, the plunger F, and the rod H, descend and impart through the wheel-work, motion to the pencil $M^1$. It will thus be obvious that the greater the speed of the carriage, and consequently the velocity of the machine, the greater will be the quantity of water which will leave the cylinder and flow into the conical vessels, and the greater also will be the travel given to the pencil.

For the purpose of determining the velocity of the carriage on different portions of the same line, the paper must be ruled transversely, with divisions corresponding to the number of miles it is desired to register, and the motion given through the wheel-work to the drum must be calculated accordingly. Thus, if the carriage wheel should make 500 revolutions in passing over a mile, and each mile is to be represented by one half inch on the registering paper, then such a system of wheel-work must be employed, as will cause the periphery of the drum to move one half inch for every 500 revolutions of the carriage wheel. To ascertain at first the travel, or motion of the pencil due to a certain number of revolutions of the instrument per minute, it is connected to some system of wheel-work, the speed of which is known, and the point at which the pencil stands with this velocity is marked. By changing therefore the velocities of the wheel-work, any number of points may be so marked off, and a proper scale of the working of the apparatus obtained, each division of which would correspond to a certain number of revolutions per minute of the instrument. Moreover, by comparing the relative sizes of the carriage wheel and the pulleys, by which the instrument is put in motion when fitted to the carriage, the correct speed at which the carriage is moving can be found.

For instance, if the mark made by the pencil when the instrument was revolving at 1500 revolutions per minute, should be the point determined to mark 60 miles an hour; and if the carriage wheel makes 500 revolutions in one mile, then the instrument must be caused to make three revolutions for one revolution of the carriage wheel, in which case if the instrument makes 1500 revolutions in one minute, then the carriage will have moved one mile in one minute, or at the rate of sixty miles per hour.

A modification of the apparatus just described is represented in fig. 3. In this case the registering pencil is put in motion through the medium of compressed air,

much in the same way as in the apparatus before described. The pipes AA, form a connection for the passage of compressed air into the hemispherical vessel B, where it acts upon the diaphragm C, the plunger in this case is represented as forced up.

An apparatus for registering the pressure of steam, may, with great advantage be connected with either of the instruments last hereinbefore specified, so that both the registration of the pressure of the steam and the registration of the velocity of the carriage may be printed on the same paper. In this case it will be proper, in order to prevent confusion, that the scale for the pressure of the steam should alone be marked on the paper, and that the scale for the velocity should be applied occasionally to the paper as required; as also, that different-coloured pencils should be used to distinguish the pressure from the velocity.

My improvements in apparatus for ascertaining the length of time elapsed after a train of carriages have passed a given place, are embodied in the apparatus represented in fig. 4 (partly in section). In this apparatus the passing of a carriage wheel is made to press down one end of the lever A, which projects on the side of the rail B, after which the other end of the lever is raised up, and carries with it a vertical rod C, to some determined height (about 4 inches will be found in practice sufficient), above the bearing $C^1$. The connection between the lever A, and rod C, is formed by a link $C^2$. The rod C, is in a position, when raised, to act on a suitable catch apparatus fixed on the engine or carriage, and working a whistle, or other signal. Many appaoved methods of working such levers and signals are well known, and need not therefore be here particularized. To keep the rod C, in a position to act on the signal apparatus, some determined and required length of time, I make use of the following arrangement:—D is a short cylinder, which is firmly fixed in a position under the level of the rails, where it may be protected from dirt and rain. $D^1$ is a metal disc valve, which is fitted to the bottom of this cylinder and opens upwards; the valve facing is covered with vulcanized India rubber to form an air-tight joint, and the joint is further secured by a spring $D^2$. Figs. 5, and 6, are separate representations of the valve. In the centre of the valve there is pierced a small hole $D^3$, which is countersunk, and also provided on both sides with a hemispherical covering of fine wire gauze to prevent clogging. $D^4$ is a diaphragm jointed air-tight upon the top of the cylinder to prevent all direct communication with the atmosphere, and so to keep the valve and the opening $D^3$, entirely free from dust. E is an expansible air-tube, made of vulcanized India rubber (somewhat resembling a circular bellows, but without its central partition, or valves), which tube is jointed at top to the cylinder D, and has an air-tight bottom F, which projects sufficiently to connect it by the frame GG, to the lever A. The working of this apparatus is as follows:—When a carriage wheel presses down the short end of the lever A, that causes the long end of the rod C to rise together with the bottom part of the air apparatus, which last causes the air in the tube E to rush through the valve into the cylinder D. As the proportion of size of the hole, D, is to the weight of the frame and under part of the tube, so will be the length of time occupied in drawing back the air out of the cylinder into the lower part of the apparatus, and in causing the frame and rod C to descend, as represented in fig. 7, The determinate length of time thus allowed to the rod C, to project above its bearing, will by its action upon the signal apparatus give notice that a previous train has passed within a given time.

## ON SECONDARY EMPLOYMENT FOR OPERATIVES.

(Concluded from page 358.)

Facts seem to point out field and garden labour as, generally speaking, the most appropriate secondary employment for factory operatives. As a sanitary expedient for improving the health, and contributing to the long life of persons confined a great portion of the day in factories, nothing has yet been found so efficacious as exercise in the open air. Experience proves that gardening, at

least, is congenial to the natural inclinations of all ranks; it is seen in the independent classes as it is in the lower grades of society, that gardening is had recourse to as an amusement; thus many of the best of the artificers in Portsmouth-yard rented small plots of ground, repairing to them after a hard day's work, to delve or plant, as a relaxation; so of late, particularly at Leeds, manufacturers have found that letting out a portion of their land in allotments to their operatives has been considered by them as a source of great enjoyment, and the boon has been productive of most beneficial effects in the conduct of the allottees. The *Gardener's Chronicle* affords, as do many other publications, very numerous instances of the good that has been done by similar lettings out of small portions of ground. But the chief recommendation of field or garden work as a secondary employment is, that work of this kind is more likely to be procured than any other when the ordinary business in factories fail. Field or garden work is not, however, to be considered as the sole panacea; operatives themselves may be looked upon as usually the most competent judges of what secondary employment it would be best for them to habituate themselves to; persons of this class are believed of late years to have greatly improved in religion, morality, sobriety, and forethought; if with literary instruction they have learnt forethought, they will themselves perceive how desirable it is that they should be able to earn a livelihood though their chief means of obtaining it should fail. In the present controversy respecting "ragged schools," their opponents have said it is mischievous that boys should be taught tailoring and shoemaking, because they are not made adepts in those arts; but supposing that all boys of the labouring classes were instructed, though but superficially in them, as also in common carpentry, basket-making, and the like, might not a very little knowledge of these arts enable them, when men, to do many a little job to render their homes more comfortable, and induce them to spend their time more profitably than in the beer-house?

Your correspondent "A. H," hesitates to accede to the assumption that our acres are not broad enough to furnish food to the whole community. That we have still much waste land is most true: granted also that a still greater extent of it is indifferently, nay miserably, ill-cultivated; and that much of it might easily be made more productive, and to yield food in place of some of that we now import. So long ago as the year 1601 "H. Platt, Esquire," published "The new found Arte of setting of Corn." He recommended spade husbandry instead of the plough, and the dibbling in of corn instead of sowing it broadcast; by these means he confidently hoped that the produce of an acre might be increased ten or twenty-fold, and that by this practice "there would scarcelie be found workmen enough for the tenth acre of the land,"—a proposition highly in favour of husbandry as a secondary employment for operatives. Mr. Platt's improvements have, to a certain extent been introduced in drill husbandry, for instance, and authentic agricultural experiments have proved that by spade-husbandry the produce of the land might be prodigiously increased; but would the practice of it *pay?* Putting both rent and farmer's-profit entirely out of the question, would the yield of the land give the digger an average remuneration for his labour at all commensurate with what he receives as factory wages, unless, indeed, free-trade in corn were again abolished? It is at this moment a question amongst agriculturists whether high cultivation of any kind *pays*. It is even affirmed that the slovenly farmer of the old school has at the year's end considerable profits to exhibit in his books, whilst those of the *high* cultivator show a serious deficit. It has often been said of late that the reason why France, for example, can raise corn at a cheaper rate than we can is, that they, "the French, have *no taxes*." This is a mistake, and one that fosters much discontent amongst our people. The French have a land-tax, a window and a door-tax—imposed on the cottage and the farm as much as on the chateau; they have a salt and a tobacco-tax; excepting corn, every article of food that enters each little town is taxed; so is wine, the common beverage of the people in the greater part of France; and there are besides various other taxes, that either directly or indirectly bear upon the great

mass of French population. Chambers, in his *Edinburgh Journal*, 30th of last March, has touched upon the different habits of French and Englishmen of the labouring classes, and to this, apparently, may be attributed, more than to any other cause, that French corn can be sold at a lower price than English. At Sunderland, Chambers "grieves to say" that he found, "as almost everywhere else, misspent means, intemperance, and all the evils that follow in its train;" at the same place he found a *Frenchman*, "of different tastes and habits,"—that this operative exercised "a reasonable economy, and would probably return to his own country with considerable savings." The frugal habits of the French enable them to raise corn and to sell it at a lower price than we can; so it is in Russia, and probably in most, if not all, the other countries that supply us with grain.

Your correspondent seems to look forward to the breaking up of our large farms into peasant holdings. Such tenures seem abroad highly conducive to the self-respect of the little landholder; but it is questionable whether the produce of the land is in an equal ratio with that of the large farm; that is where the capital for carrying on the latter is of the requisite amount. In Tuscany peasant holdings, or rather small farms, are said to be cultivated with extreme care and skill, and to yield enormous crops; but those crops are of many different kinds, and afford work during the whole of the year: our climate limits us to a much less number, so that the corn once sown, there is nothing more to be done, save having a patch of turnips perhaps, till harvest time. We are not aware, besides, of the miseries peasant holders abroad endure in bad years—so that investigation might show that, all things considered, we have no better outlet than factories for excess of population.

These observations have already extended to so great a length as to render it impossible to touch upon other important matter brought forward by A. H.; particularly his questions as to the causes to which the cheapening of our manufactures are owing. Indeed, the inquiry into those causes is of an interest worthy of his own investigation; and of the same endeavour to eliminate the truth that his papers and your columns have already manifested.

I am, Sir, yours, &c.,
M. S. B.

## THE HOLYHEAD AND DUBLIN STEAMERS.

(Concluded from page 350.)

While, however, the *Llewellyn* has been on the whole a successful vessel, it was her misfortune, after a few weeks' running, to break down, and to be sent round to London for a new cylinder. In August and September, the Chester Railway Company's steamers —*Anglia*, *Cambria*, *Hibernia*, and *Scotia*—commenced running. The whole of these vessels are of iron: the *Anglia* was built by Mare, of Blackwall—engines by Maudslay, on the double-cylinder principle: the *Cambria* by Laird, engines by Forrester; the *Hibernia* by Vernon, of Liverpool, engines by Bury; and the *Scotia* by Wigram, of Blackwall, with engines (double-cylinder) by Maudslay. Before proceeding to discuss further the merits of the Admiralty and Railway Company's steamers, I will give a Table of the dimensions, power, &c., of each, with the exception of the *Caradoc*, which I have been, as yet, unable to procure.—(See p. 366.)

The service performed by the Admiralty and Railway boats, on their first introduction in August, 1848, was pretty similar, being confined to one passage each way per day. The former conveyed the day mail from Dublin and the night one from London, and the latter, by leaving Kingstown early in the morning, enabled passengers to reach Holyhead in time for the afternoon express train, which arrives about 10 P.M. in London. The same vessel awaited the arrival of the down express train from London, and was generally due at Kingstown about 10·30 P.M. Since the completion of the Britannia Bridge, the arrangements of the Company have been slightly altered; but up to the present time no material alteration has been effected. It should, however, be observed, that while the Admiralty have allowed 5 h. 35 m. and 5 h. 55 m. for their vessels to complete their passage in, the Railway Company have limited theirs to 5 h. 5 m.; and I believe that the instances in which they have failed to arrive at Holyhead in time for the train, are not more numerous than

those of the Government ones.* It should also be remarked, that the pressure used on board all of the Company's vessels is fixed at 10 lbs., but on those of the Admiralty at 12 lbs. In July, 1849, the discontinuance of the night mail, *viâ* Liverpool, and its transference again to the Holyhead station, necessitated a double passage each way, and the work performed by the Admiralty steamers became, in consequence, much heavier, and in winter time occasionally of a very difficult character. The merits of the different vessels were put to a severe test; and while it was found necessary to employ additional steam ships as winter approached, yet two, namely, the *Banshee* and *Llewellyn*, may be said to have sustained their character well. At the present time the *Banshee*, although exposed to the hard gales of April, is showing no diminution in speed. It was a pretty general opinion that this vessel was unmatched for speed by any of the other vessels on the same line, or, indeed, anywhere else; but experience has shown the contrary. The *Scotia*, in a run from the Head, on 24th of May, 1849, beat her by fully 20 minutes. On this occasion the *Banshee*, being specially engaged for the conveyance of the Lord Lieutenant, who came by the London express train, left Holyhead at the same time as the *Scotia* (6 P.M.) At first she took the lead, but the *Scotia* rapidly gained upon her, and soon left her far astern. The passages of the two vessels were made in 3 h. 54 m. and 4 h. 14 m. respectively. In February, 1849, a trial of speed was specially instituted between the *Banshee* and *Llewellyn*, in which the former had the advantage, in the run from Holyhead to Kingstown, of 17 minutes. The *Banshee's* passage was then made in 3·53—the *Llewellyn's* in 4·10. The *Scotia* trial has greatly raised the bile of the *Herald* scribe, who has laboured hard to lessen its importance; but facts are stubborn things, and, despite all his eloquence, they have not, in this instance, been refuted. The true cause, however, of this spleen is, the fact of the *Scotia* beating a vessel that beat the *Llewellyn*. I now subjoin a tabular statement of the performances of the Admiralty vessels for January, April, October, and December, 1849, and January and February, 1850.

Dimensions, &c., of the Chester and Holyhead Railway Company's Steam Ships, Anglia, Cambria, Hibernia, and Scotia. Some Dimensions, &c., of the Admiralty Steam Ships Banshee, Llewellyn, and St. Columba.

| Name of Vessel. | Builders. | Total Cost. | Material. | Length. | Breadth. | Depth. | Tonnage. | Draught. For. | Draught. Aft. | Engineer. | Form of engines. | Horse-power. | Diameter of cylind. | Diam. of paddle-wheel. | Pressure. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | lbs. |
| Anglia ...... | Mare & Co., Blackwall. | £36,480 | Iron. | 190 ft. | $26\frac{2}{10}$ | 14 | 473 | 8·3 | 8·4 | Maudslays, London. | Doub. cylin. | 350 | 48½ | 24·7½ | 10 |
| Cambria...... | Laird, Birkenhead ...... | 37,200 | Do. | 208 ,, | $26\frac{2}{10}$ | $14\frac{4}{10}$ | 635 | 9·4 | 9·3 | Forrester, Liverpool. | Beam. | 350 | 72 5-ft. stk. | 28 | 10 |
| Hibernia .... | Vernon, Liverpool ...... | 36,750 | Do. | $197\frac{2}{10}$ | 26·9 | $14\frac{1}{10}$ | 573 | 9·4 | 9·1 | Bury, Liverpool. | Oscillating. | 370 | 73 | 27·7 | 10 |
| Scotia ......... | Wigram, Blackwall...... | 36,540 | Do. | 194 ,, | $27\frac{1}{10}$ | $13\frac{2}{10}$ | 479 | 8·4½ | 8·6 | Maudslays, London. | Doub. cylin. | 400 | 52 | 28·8 | 10 |
| Banshee...... | Thompson, London...... | ...... | Wood. | 189 ,, | 27·2 | 14·9 | 670 | 8·10 | 9·2 | Penn, Greenwich. | Oscillating. | 350 | 72 5-ft. stk. | 25 | 12 |
| Llewellyn ... | Miller & Co., Blackwall | ...... | Iron. | 190 ,, | 26·7 | 15· | 643[illegible] | 8·7½ | 9· | Miller & Co., Blackwall. | Do. | 350 | 68 6-ft. stk. | ...... | 12 |
| St. Columba. | Laird, Birkenhead ...... | ...... | Do. | 198·6½ | 27·3 | 15 5 | 655 | 9·2 | 8·7½ | Forrester & Co., Lpool. | Beam | 350 | 72 | 28 | 12 |

The average consumption of coal by the Company's steam ships in each passage, 11 tons, 8 cwt. Ditto each ship, 11 tons, 15 cwt. Ditto per hour, 3 tons, or thereabouts. The consumption by the Admiralty vessels is, I believe, higher.

* See note, p. 368.

STATEMENT (A.)

| Date. | Vessel. | No. of Passages. | Shortest Passage. | Longest Passage. | Average Passage. | Remarks. |
|---|---|---|---|---|---|---|
| January, 1849 ....... | Banshee..... | 23 | 3·38 | 7·43 | 4·15 | In this month the Company's ships—Anglia, Cambria, and Hibernia—made passages as annexed, which can be compared with those of the Admiralty. |
| | Caradoc .... | 10 | 3·59 | 5 16 | 4·44 | |
| | Llewellyn ... | 18 | 3·44 | 4·50 | 4 10 | |
| | St. Columba.. | 11 | 4·29 | 6·30 | 4·49 | |
| April, 1849 ......... | Banshee .... | 21 | 3·34 | 4·32 | 3·59 | |
| | Llewellyn ... | 21 | 3·40 | 4·30 | 3·58 | |
| | St. Columba.. | 20 | 4·13 | 5·15 | 4·31 | |
| October, 1849 ....... | Caradoc .... | .... | .... | .... | 4·40 | Total number of miles gone over by Caradoc ....... 2304; stat. miles per h., 13·82; kts. per h., 12 |
| | St. Columba.. | .... | .... | .... | 5·2 | Ditto St. Columba.... 2588; „ 12·02; „ 10·44 |
| | Vivid....... | .... | .... | .... | 4·14·4 | Ditto Vivid ......... 2910; „ 15·25; „ 13·23 |
| December, 1849...... | Llewellyn ... | 34 | 3·40 | 5·3 | 4·6 | |
| | Banshee .... | 32 | 3·41 | 5·26 | 4·17 | |
| | Vivid....... | 16 | 3·48 | 6·15 | 4·32 | |
| | St. Columba.. | 28 | 4·21 | 6·5 | 5·0 | |
| | Caradoc .... | 14 | 4·5 | 7·40 | 5·24 | |
| January, 1850 ....... | Llewellyn ... | 20 | 3·46 | 5·42 | 4.11¼ | |
| | Banshee .... | 30 | 3·42 | 5·37 | 4·30 | |
| | Vivid....... | 24 | 3·48 | 6·15 | 4·22 | |
| | St. Columba.. | 26 | 4·27 | 5·40 | 4·53 | |
| February, 1850 ...... | Llewellyn ... | 34 | 3·41 | 8·0 | 4·23 | The weather during this month was remarkably severe. The Llewellyn's eight hours' passage was made during a hard gale from the north-west—the worst which has occurred since the memorable one of January, 1839. The Llewellyn, however, was not out, like the Company's ship Cambria, in the height of it. The Cambria's passage occupied fifteen hours. |
| | Banshee .... | 36 | 3·41 | 5·0 | 4·12 | |
| | Vivid ...... | 12 | 4·10 | 5·25 | 4·32 | |
| | St. Columba.. | 8 | 4·30 | 8·57 | 5·22 | |
| | Fire Queen.. | 7 | 4·30 | 9·20 | 5·18 | |
| | Caradoc .... | 10 | 4·10 | 4·40 | 4·28 | |
| | Scotia ...... | 4 | 4·19 | 4·30 | 4·25 | The number of passages made by the steam ships of both Admiralty and Company, from August 1848 to August 1849, are as under:— |

| | No. of Passages. | Shortest Passage. | Longest Passage. | Average Passage. |
|---|---|---|---|---|
| Anglia...... | 19 | 3·33 | 0·58 | 4·22 |
| Cambria .... | 22 | 4·7 | 4·50 | 4·21 |
| Hibernia.... | 12 | 4·28 | 6·38 | 4·56 |

| | | | |
|---|---|---|---|
| Banshee........ | 202 | Anglia........ | 144 |
| Caradoc........ | 204 | Cambria ...... | 264 |
| Llewellyn....... | 180 | Hibernia...... | 82 |
| St. Columba .... | 230 | Scotia ........ | 132 |

It will be remarked that in the account for October, December, January, and February, the name of the *Vivid* appears. This beautiful vessel, which may be called the *Banshee's* little sister, was constructed a short time after her at Chatham Dockyard, by O. W. Lang, on precisely the same principle; and has, likewise, oscillating engines by Penn. She was built for, and is better adapted for the shorter passage between Dover and Boulogne, but, notwithstanding, performed her work while on the Irish station, during severe winter weather, remarkably well. In speed, she and the *Banshee* are very nearly alike; and when the two vessels were in company last summer, as forming a portion of the Royal Squadron, and were on their way from Cork to Dublin, a trial was commenced between them, which resulted in the *Vivid* gaining a slight advantage. The following are some of the dimensions, &c., of this vessel:

| | | | |
|---|---|---|---|
| Length | 150 feet | Tonnage | 352 |
| Breadth | 22 ft. 1 in. | Power | 150H.P. |
| Depth | 11 ft. 4 in. | | |

The *Fire Queen* was another extra vessel, and but ill-adapted for the station. She is of iron, and was built in the Clyde for Ashton Smith, Esq., of whom she was purchased by the Government. She was intended for a pleasure yacht, and is too slightly constructed for the Irish Channel duties. In February of this year, several of the Admiralty boats being put *hors de combat*, the *Scotia* was hired to supply the deficiency, which accounts for her appearing amongst the list. With respect to the Company's vessels, the *Scotia* and *Anglia* have proved themselves by far the fastest, and have reflected no small credit on Thames ship-building and engineering. The *Cambria* and *Hibernia*, Liverpool vessels, have not shown the like speed, but the *Hibernia* is the slowest, owing in great measure to her engines being placed too far aft. It is due, however, to the *Cambria* to state, that she has performed more work than any of the rest, and has shown herself an excellent sea-boat. The *Anglia* and *Scotia* are very nearly matched in speed, and I should consider the former equal, if not superior, to any of the Government boats. No opportunity, that I am aware of, has offered, as in the *Scotia's* case, of putting this to a practical test. The general average passage of these vessels during the past month (April) is stated by Mr. Gray, the Company's manager at Kingstown, to be 4h. 25m. 8s., of each 4h. 15m. 40s. To this gentleman's kindness I am indebted for much valuable information respecting the ships he superintends.

In March, the Admiralty having become tired of wasting the money of the public in a needless competition with the Company, were suddenly seized with a very economical fit, and determined on offering the mail service to the lowest bidder. The City of Dublin Company, who previously tendered for its performance for 40,000*l*., now offered to do it for about half that sum. Their offer was accepted, and with two of their own ships, and two of the Government (the *Llewellyn* and *St. Columba*, which it is understood they have purchased), they have since the 1st inst. entered upon the performance of this service. Whether this sum is sufficiently remunerative, provided the duties are executed in a manner equal to the past performances of the Government and Company's vessels, is very doubtful. One thing is, however, certain, that although the successful company is an Irish one, all parties, except interested ones, on this side the Channel, are loud in their condemnation of the paltry conduct of the Government. Perhaps I may hereafter have somewhat more to say on the subject; meanwhile I will for the present conclude.

I am, Sir, yours, &c.,
L. N.

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* The departure of the Mail and Company's boats from Kingstown, and the time allowed for the completion of their passages, are as under:—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mail leaves Kingstown | 1 | P.M. | (Dublin time) | to meet train leaving Holyhead at | 6·35 P.M. | Time allowed for completion of passage | 5·35 |
| Ditto | 7·30 | P.M. | do. | do. | 1·35 A.M. | do. | 5·55 |
| Railway Company's boat leaves Kingstown | 9 | A.M. | do. | do. | 2·5 P.M. | do. | 5·5 |

### OIL OF TURPENTINE AN ANTIDOTE TO MOTHS.

Shreds of Russia leather are often put amongst garments when not in use to preserve them from moths; so is camphor, but neither of these seem so effectual as common oil of turpentine.

A simple way of using oil of turpentine, for the protection of woollens and furs, is to saturate bits of flannel with the oil, and to wrap them up separately in clean woollen, linen, or cotton cloth, to prevent the oil from penetrating to the outside of the wrappers, and injuring the articles around them. Six or seven pieces of thick flannel, each about a quarter of a yard square, are sufficient for a trunk 4 feet long, by 18 inches broad and deep; a layer of the garments to be protected should be first laid in the trunk, upon it two pieces of the prepared flannel, then a layer of garments, and so on a layer of garments, and a piece or two of the prepared flannel, till the trunk is about half full; above which may be filled in with garments alone. The lid of the trunk should then be immediately shut down, to prevent escape of the oil by evaporation.

Cloths have thus been perfectly protected in the same room where a Cashmere shawl, carefully wrapped up with camphor, became much moth-eaten.

Should there be occasion to open such a trunk, the oil of turpentine should be renewed, otherwise the quantity above indicated is sufficient for the protection of articles within a close shutting trunk for five or six months.

The smell of turpentine contracted by garments goes off by exposing them a few hours to the air.

M. S. B.

### PUBLIC WORKS' BLUNDERING.

The frequent blunders, as Mr. Hume denominates them, that are made in engineering and architectural works, seem abundantly to prove that designs for great works are not sufficiently investigated previously to their execution. No longer ago than the 26th ult., Lord Portman, in the House of Lords, called the attention of the Lord Privy Seal to a petition respecting the Breakwater and Harbour of Refuge now constructing off the Isle of Portland. The petitioners complained that the extent of the breakwater was not sufficient for the object in view, and also that the proposed defences of the harbour were not sufficient for the protection of ships in it against the attacks of an enemy. These allegations of the petitioners may or may not be well founded,—the public have not been furnished with means of forming a correct judgment on the subject; but the *blunder* which, on the same day, was matter of discussion in the House of Commons, is undoubted. It has been discovered that in the New Palace in Westminster, sufficient accommodation for the Members of the House of Commons has not been provided;—that where six rows of seats had been intended on each side of the chamber, there is only space for five;—that, in order to find room for the members, it becomes necessary to fit up for their accommodation a large gallery at the end of the House.

The practical inference to be drawn from such mistakes is, that means should be resorted to for putting the designs for great works to the test of extensive scrutiny previously to their execution; and, in this Magazine 1855, a mode is pointed out by which this may be accomplished; namely, by the drawing up of the desiderata in any proposed work, and distributing extensively the paper, together with the plan proposed, to a variety of persons supposed competent to judge of its sufficiency and merits, requesting at the same time impartial observation. It seems useless to repeat what has already appeared in pages 78, 79, 84, and 85 of that Number of this Magazine; but another example may be now cited of Sir Samuel Bentham's practice during his official employment in the year 1800, when his plan for the better management of the Royal Dockyards was completed. Although it obtained the entire approbation of the Board of Admiralty, he requested that it might be printed and distributed to the several persons interested in the new arrangements, or that might be thought most competent to form a judgment of their expediency. Their lordships were pleased to acquiesce in the proposal: numerous comments on the plan were returned to the Admiralty, and were put into Sir Samuel's hands. Observations on objections made to some of his proposals may be seen in his "Naval

Papers," No. 8. That the expediency of the proposed measures was confirmed by this investigation, is not to the present purpose; but it is so, that the publication of a plan, together with an invitation to discuss its merits and to exhibit its defects, seems a safe mode of obtaining criticism whilst there is yet time to profit by it, and thus save many a useless draught on the public purse.

In Number 1355, examples are adduced of oversights that, probably, would have been prevented by a more general discussion of the plan for the New Palace in Westminster; and so might have been the newly-discovered *blunder*. Persons really desirous of perfecting the plan, and having sufficient leisure, would have examined details, and pointed out for correction deficiencies. Even as to superficial observers, many amongst them might, on a general reference to the space in which large assemblies meet, as in the pit of a theatre, have concluded that there was abundant room allotted in the House of Commons for its Members; but the idea might have struck some Paul Pry amongst the number, that members sitting out a debate for many long hours together might be indulged with more ample space, and would have set himself to measure in how much a man could sit at perfect ease, and then to measuring the plan of the floor of the intended House of Commons, and so to satisfy himself whether or not it afforded 655 times the space requisite for a single man.

The additional 500*l.* which the intended temporary arrangement of the gallery will cost the nation, is but a trifling consideration compared to want of unity in the accommodation for the Members of the House of Commons. In that assembly it is naturally inferred that all the individuals of it should be upon a par to the eye as well as in fact, but this equality will be disturbed by seating some of the members on the floor, others of them in an elevated gallery. Real inconvenience will be, the result, too; all the members of the House are supposed to be at once within the range of the speaker's eye — impossible, if some of them are to be aloft whilst others are on the floor. Then how fatiguing will it be for him to have to stretch his head upwards during a two or three hours' speech! Indeed, this gallery, if adopted, may lead to the introduction of a *tribune* for the orators, and thus may end the happy influence which an unpremeditated speech has hitherto had on debates in our Houses of Peers and Commons.

The higher established architects and engineers possibly may still spurn the idea of a canvass of their plans, but young aspirants to distinction, it is hoped, will perceive the advantages of submitting their designs to criticism previously to any final decision on them. The deviser would derive present satisfaction from being thus enabled, ere too late, to correct any error he may have fallen into; and from availing himself of hints for the improvement of his own conceptions, would thus satisfy his employer that no endeavour had been wanting on his part to perfect the design for a work that had been intrusted to him; and ultimately there would be no longer ground for such bitter sarcasms as the talented architect of the new Palace in Westminster is constrained so often to endure.

M. S. B.

## THE TRUE MEANS OF IMPROVING THE TASTE OF OUR ARTIZANS.

If it is really the object of the patriotic and art-loving promoters of the Exposition of the Works of Industry of all Nations to educate the eyes and minds of our own artizans, and to inoculate them with the principles of true taste, by bringing under their observation specimens of the handicraft of every class of workers in the world, then it must be confessed that they have adopted the most eccentric course to effect this great desideratum; one, the influence whereof will be ephemeral, the cost beyond all calculation, and the effects very doubtful, if not absolutely pernicious. For, of a certainty, this monstrous *omnium gatherum*, which is to contain every article of manufacture, from the hideous productions of the Chinese, to the meretricious works of the Parisians — in forming which no selection or discrimination is to be used—must produce upon such as are not yet initiated into the "mysteries of art," results the very opposite to those which are professed to be desired. The few objects intrinsically good will be smothered by what are intrinsically bad, although of a

showy external appearance, designed and manufactured expressly to please the vulgar and the ignorant. It must follow, therefore, from this Exposition, as a natural consequence, that public taste will be blinded to truth and perverted to falsehood—confirmed in prejudices instead of being enlightened. Without entering upon the *vexata quæstio* of the merits of this scheme, which have been fully discussed in the pages of the *Mechanics' Magazine*, we may be allowed to suppose that it was perfectly practicable to establish a permanent instead of a temporary collection, and to exercise a severe discrimination in selecting the objects for it—rejecting all such as were calculated to lure the uneducated and the wavering into error. Even then, although the preceding remarks would scarcely be applicable, we should be inclined to enter a demurrer against it, because we believe cheaper and more efficient means of educating our designers are at hand. Take, for instance, a designer of shawl patterns. If it were desired to instruct him in correct drawing, in a graceful combination of colours, the blending of a thousand tints into one harmonious whole, what school so fit for him to study in as that which contains the *chef d'œuvres* of the greatest painters and sculptors of mediæval and ancient times—the British Museum and the National Gallery? That the study of such masterpieces is the best means of promoting and cultivating public taste few will gainsay, and it is to the facility with which workmen in continental cities may do so, that their supremacy in this respect is mainly due. For acquaintance with the artistic productions of genius begets admiration, and the power of comprehending them kindles a desire to imitate, that is to say to realize the imaginings of a poetic mind, in giving to things inanimate forms of lifelike beauty. Such, then, being our belief, we purpose to consider what opportunities for studies of this nature are offered to the public by the various national exhibitions, and what facilities are afforded by the Trustees or Directors of them. Also, how they may be improved so as to be elevated into the position of instructors, instead of being allowed to degenerate into mere repositories for the curiosities of art.

As regards the National Gallery—the opportunities for inspecting its contents, and the manner in which the paintings are exposed to (or rather shrouded from) public gaze. It is a fact patent to every visitor, and notorious, by report, to the dilettanti of the continent, that ours is the poorest, numerically speaking, of all national collections; that the students are allowed only two days in a week to copy, whereas, in the Louvre, and elsewhere, they are free to do so every week-day; and that the rooms are so small and ill-lighted, that unless the gazer has a wry neck and the power of seeing through obscurity, the beauties of the paintings are lost to him; while last, though not least, the specimens of the various masters are jumbled together in such strange confusion, instead of being arranged systematically, and in schools, that their instructive effect is neutralized to a considerable extent, inasmuch as it becomes a matter of no small difficulty to compare and note the peculiar characteristics of different disciples of one school. The building itself, as has been often remarked, is most unfit for the purposes to which it is devoted. To call such a mean, pepper-box crowned, structure "The British National Gallery of Painting," is at once to stigmatise British taste and national folly—to link ideas of all that is *grandiose* and of sterling worth with practical exhibitions of the ridiculous and absurd. How the architect, poor Wilkins, was "cribbed, cabined, and confined" in his plans, or rather, how he was obliged to alter, modify, and adapt his original design to suit the instructions of the Trustees, in accordance with the wishes of the Royal Academy—a body corporate, exclusive in the extreme, jealous of non-academic genius, and existing on the generosity of the public, seeking to exalt the talent of its members at the expense of the fame of the masters of their art—is a matter of history too well known, and too generally regretted to be again brought before the world. Nor should we have alluded to it, had it not been recently stated by the Prime Minister of England, in reply to a question of Mr. Hume's, that it was the intention of Her Majesty's Government to transfer the Vernon collection from the cellars of Trafalgar-square to the ante-rooms of Marlborough-house, and ultimately to provide new apartments for the Royal

Academy, surrendering what they now occupy to the National Gallery. Now, in justice to the nation, to donors of pictures, and to the interests of art, such an act of bad faith and vandalism should never be allowed to be consummated. The National Gallery was sacrificed to the convenience of the Royal Academy. Why should it again be sacrificed to the newborn love of architectural pretensions exhibited by the latter? Better by far give up unreservedly, and for ever, the National Gallery to the Royal Academy—fit habitation for such a body—and devote the sum intended for it to the formation of a fun dh ereafter to be applied to the building of a really National Gallery. One which shall show in an architectural point of view some deference to the principles of good taste and common sense, and, above all things, possess the requisites, both as regards size and light, for the proper exhibition of the paintings.

With respect to the sculpture and print departments of the British Museum—the only ones which come within range of the present arguments. The few pictures and portraits which are, or used to be, hung close underneath the ceiling—the light being admitted from the centre of it—and above the cases filled with stuffed birds, fossils, reptiles, &c., are most assuredly anything but distinctly visible, and, consequently, entirely useless for instruction. Like the National Gallery, both these exhibitions have been managed with the same disregard for the interests of art and the public. The print department can scarcely be called a public exhibition, from the fact that it is only opened to the select few to whom tickets are issued. Whether the exclusion of the public generally is a wise precaution or not, is not now in question. Although experience proves that they are, after all, the best and most jealous guardians of their own property, and that whatever act of spoilation is committed is invariably done by those, "the (real) vulgar," whose position would procure them admission according to the present regulations—witness the destruction of the Portland vase! Yet the sculpture galleries are really opened to the public for a few hours during three days of the week, and exercise a more decided influence than the other—serving at once to instruct the student and delight the pleasure-seeker. Perhaps there is no collection in the world so rich in the great works of the great masters of antiquity, which served as sources of instruction and inspiration to their successors of the middle ages, which has produced such insignificant results. With an increasing population, actuated with increasing love and appreciation of art, periodical irruptions of eager sightseers, whose number is augmented year by year, thanks to the facilities of locomotion, the number of students and visitors to the sculpture gallery, a short time since actually declined, and has only within the last year or two rallied, although far from proceeding *pari passu* with the spirit of the age. Why this should be so, is for the authorities to answer.* It scarcely required a Parliamentary Commission to indicate their grievous sins of omission—their leaving the whole management of the various collections committed to their charge to the salaried heads of each, who were constantly at variance, if not actually quarrelling with each other, and who acted independently of the collective interests of the Museum, and carried their insubordination and contempt for him who was, *de facto*, their chief, to such an extent as to ignore his recommendations and exclude him from their deliberations. From this system of *laissez faire et laissez passer* resulted all those sad expensive blunders which the nation now so sincerely deplores. The officers, allowed to do as best suited their pleasure and convenience, and to pass off their errors as the results of hypercritical acumen far beyond the ken of the public.—The architect allowed to reproduce his one idea for a façade because he was the officer of the Trustees, and had, forsooth, suggested the design some quarter of a century ago, as if the experience and progress of twenty-five years could not improve and embellish his crude plan.

* The number of visits made by artists and students to the galleries of sculpture for the purpose of study was, in 1831, about 4,938; 6,081 in 1835; 6,354 in 1840; 5,655 in 1841; 5,627 in 1842; 4,907 in 1843; 5,486 in 1844; 4,256 in 1845; 4,124 in 1846; 3,508 in 1847; 3,694 in 1848; 6,804 in 1849. The number of visits made to the print-room was 4,400 in 1832; 1,065 in 1835; 6,717 in 1840; 7,744 in 1841; 8,781 in 1842; 8,162 in 1843; 8,998 in 1844; 5,904 in 1845; 4,390 in 1846; 4,572 in 1847; 5,813 in 1848; 5,970 in 1849.—*From a Return relative to the British Museum recently published.*

And even this very unpretending piece of architecture is further disfigured by the erection on each side of it of buildings to be appropriated for the residences of the officers of the Museum, and which but partially screen the brick sides of the body of the building which intrude themselves on public view, as if to expose the deception of the stone facing. Further, the construction of the apartments is, in many instances, most defective for viewing the pieces of sculpture, ranged, as they are, against walls, and dimly lighted through a skylight or *œil de bœuf*, while some of the rooms which are at all passable have been rebuilt; and even in them the smaller pieces are stowed away behind doors, and in recesses, or shrouded behind huge sarcophagi.

In the restoration or arrangement of the friezes, and other works of art, it would appear that the officers of the Museum have been as unfortunate as their brethren of the National Gallery in cleansing; for, according to the evidence of Sir Charles Fellowes, Sir Richard Westmacott refused to be guided by his information, which was acquired by actual observation, and fortified by drawings made on the spot, and induced the Trustees to adopt his (Sir Richard's) plan for the arrangement of the Lycian marbles, in which friezes of different styles and epochs were jumbled together—*rudis indigestaque moles*. Yet, although immense sums have been spent in building that portion of the Museum destined to receive those works of sculptural art wherewith the nation is endowed through the munificence of individuals, we believe that it is even now filled to repletion, and that a vast quantity of similar treasures are crowded into the cellars, so that no provision is made for what may hereafter be added.

The *fons et origo malis* in respect to the National Gallery and British Museum, is the irresponsibility of the Trustees, which may be justly said to be the result of the merely honorary nature of their office, and the absence of any active and controlling power which could and would enforce obedience and unity of action among the different *employés*. Honorary commissioners have never yet been found very energetic and diligent, if we except Parliamentary ones, whose incentive to exertion is future fame and position. Even the purity of episcopal lawn, which shone so prominently in the Ecclesiastical Commission, could not shield it from impotency and corruption, nor preserve the funds of the church from the peculating grasp of the pet Treasurer and Secretary. How then is it to be expected that the gentlemen who, by a fiction, are called trustees, can exercise sufficient authority to insure due regard to the important interests confided to their trusteeship? What time or attention can they afford, fatigued as they are with their labours in the political, ecclesiastical, or literary arena, to devote to superintending the arrangement of collections, and arbitrating between rival heads of departments? Why may we not take a leaf from a neighbour's book, and do as in Paris?—place our public and national monuments under a government and responsible direction. The Woods and Forests, for instance, which, when purged and remodelled, would doubtless exercise an active and vigilant supervision, from the fact of the chief Commissioner having a seat in Parliament, where he is always open to questions and amenable to parliamentary censure. A Bill for consolidating the directions of the National Gallery and British Museum, and placing them under the Board of Woods and Forests, would not be likely to meet with very strenuous opposition, except from such as deprecate what they please to term centralization, and advocate the perpetuation of abuses. In this case there are no vested interests to be damaged by Government interference,—that ever-recurring cry raised by interested parties when the question of reform is mooted, and which operates as a bugbear to scare the timid and the independent from such useful reforms. Supposing a Bill of this nature passed, the very first question which would force itself upon the attention of the Legislature would be that of providing fit accommodation for the already over-crowded and rapidly-increasing stores of the Museum and Gallery; which brings us back to the first proposition,—What is to be done with the Royal Academy? In a recent article on the subject, the *Times* stated, after the manner of Sir Robert Peel, that the Government must select one of three courses—expel the Academicans, buy them out, or transfer the National Gallery elsewhere.

The last, which is the only really sensible one, it rejects, as not likely to be approved of by the public after the first failure at building a Gallery. Now, with all due deference, it is submitted, seeing that the collection is scattered—that the Vernon Gallery has been obliged to be removed, and that it is agreed on all hands that some alteration of the present state of things must be effected,—that this is an excellent opportunity for retrieving past errors, not by spending some 40,000*l.* or 50,000*l.* in providing the Academy with a new house, or in buying them out, but in devoting that sum, together with what else can be spared from the public purse, to the commencement of a proper Picture Gallery. Supposing the 100,000*l.* to be raised for the Exhibition of the Works of Industry of all Nations were collected for so national and æsthetic a project, sufficient would then be raised to warrant the Commissioners in beginning it at once. As for the *locale*, despite what may be said about closing the lungs of the metropolis, the Green-park would be the most eligible; for, situated as it is between St. James's and Hyde-parks, it is but little used by the public for recreation, and is large enough to admit of the erection of a handsome structure which could be well seen from all points, and would hereafter rival, perhaps surpass, the Louvre. It might be erected, according as accommodation was required, by building it in squares, so as to form, when completed, an enormous parallelogram, the long sides of which would be connected at intervals by cross galleries. The upper story, lighted from the roof, would be devoted to pictures, and the basement to sculpture. The elaborative skill of a Barry might be exhausted on the principal façade, or entrance-side, while any meagreness of architectural decoration on the others would be amply compensated for by their extent and imposing appearance. When the first square was completed, we would suggest that the pictures of the National Gallery and the sculptures of the Museum, which are artistic works and not curiosities of art, should be forthwith removed there. The former would be considerably augmented both in number and value by adding to them the treasures of Hampton Court and Dulwich. We are aware that two objections would be raised against any interference with Hampton Court and Dulwich. It would be urged that the pictures constituted the great attraction for our industrious population; and that Sir F. Bourgeois's bequest was now of a private nature; but the removal of Raffaelle's cartoons, Holbein's historical works, and the few other paintings of value in the former, would be no great detriment after all, nor even probably missed by the pleasure-seekers, when it is remembered how they are hung in dark closets and bedrooms, so as to be almost invisible: while in respect to the latter—seeing that the former proprietor bequeathed the pictures which it contains to the nation —we conceive that it would be no violation of the spirit of his will, although it might of the letter, to transfer them to the National Gallery. Nor can we see any reasonable objection to the removal of the sculpture to the gallery, inasmuch as the union of the sister arts is much to be desiderated, and would leave ample room for the increasing stores of the British Museum, instead of being obliged, as we shall be, to build additions to it—kind of out-houses—for their reception. To render the instruction conveyed by the exhibition of the sculptures and paintings more effective, we would recommend the adoption of a suggestion which appeared in the last Number of the *Westminster Review*, for the establishment of winter gardens, which might easily be done by erecting conservatories within the squares of the parallelogram, at sufficient distance from the walls not to interfere with the lighting of the sculpture gallery. What with our horticultural skill, facilities for procuring the choicest and rarest exotics, and other appliances to boot, there is little doubt but it would far surpass the one in the Champs Elysées. If the gardens were provided with lounges and furnished with fountains, and here and there among the flowers and foliage of different climes were placed birds of rare note and plumage, the effect would be magical in the extreme, and prove a constant source of healthy amusement and instruction to all classes of this metropolis; while to the artist, the graceful forms and varied hues of the flowers would be productive of the most beneficial effect by correcting any inclination to exaggeration, and confining him to the copying of Nature. Taken altogether

the picture gallery, the sculpture gallery, and the gardens, we very much doubt if there could be anything found in Europe to equal it. As regards the expense of maintaining them, there is not one of the most ardent of financial reformers—not even Joseph Hume himself—who would object to a grant from the public funds for so truly national and popular a purpose. After the erection of the first square of the parallelogram, the building fund might be augmented by small rates levied on the metropolitan parishes, or by the rent derived from letting the rooms in Trafalgar-square to the successors of Madame Tussaud, whose waxwork likenesses of the departed great would be fit companions for the portraits of the living unknowns which encumber the walls of the Royal Academy—or to any other fashionable showman.

UNITED STATES NAVAL DRY DOCKS.

(From the Journal of the *Franklin Institute.*)

At the present time the Americans have in progress four different dry docks, capable of docking the largest vessel afloat. These docks, from their great size and the many improvements that have been introduced, are far superior to any at present in Europe.

Of the four now building one is at Philadelphia, and is known as the floating *sectional* dry dock. It is patented by Messrs. Dakin, Moody, Burgess, and Dodge, who are at present constructing this one for the government, a considerable portion of which is already completed, and the balance in progress. When finished, this dock will consist of 10 sections, each of which has the capacity to raise 800 tons—total powers 8000 tons—and will take up a vessel of 350 feet in length. Six sections will raise a ship of the line, and the four remaining sections will raise a frigate. The sections are placed side by side, and connected by timbers at the top of the tanks. The pumps for exhausting the sections are worked by four steam engines—two of 20 and two of 12-horses power. One of each size is used on each side of the dock, and placed so that the two 20-horses engines exhaust 6 sections, and the two 12-horses engines exhaust 4 sections, a perfect uniformity of level being maintained by suitable connections.

In connection with the dock there is a large stone basin, the sides and bottom being of granite. This basin is 350 feet long and 226 feet wide, and contains a sufficient depth of water, at ordinary high tide, to float the dock and the vessel it may contain.

Immediately adjacent to, and connected with the basin, are two railways on the main land. These railways are to be of the most substantial character, and fully capable of sustaining any vessel the dock will raise.

The operation of the whole is as follows: —The sections of the dock are hauled out into the river, and water let into them until they sink deep enough to allow the vessel to be floated in. As soon as this takes place, and the vessel is properly secured, the water is pumped out of the sections, and the vessel raised out of the water. When this has been accomplished, the whole is floated into the stone basin and allowed to ground on the bottom, when the vessel may be hauled on the railway. This is effected by means of a hydraulic cylinder, of 36 inches in diameter, and 12 feet stroke, worked by an engine of 40-horses power. If necessary, two vessels may be put on the railways, and a ship of the line and frigate left on the dock, so that the capacity of the dock is equal to four vessels of large class. When required, additional ways may be put up in connection with the basin. The whole will be completed during 1851, but some of the sections will be ready this season.

B.

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 9TH, 1850.

FREDERICK OCTAVIUS PALMER, Great Sutton-street, Middlesex, gentleman. *For certain improvements in the manufacture of candles, and also in the machinery for the manufacture of such matters.* Patent dated November 2, 1849.

The patentee describes and claims:—

1. Making helical wicks of candles, consisting of a number of strands bound together by cross-gymping, or otherwise, with one of the strands of harder and stiffer substance than the others, in order to support and maintain them in position.

2. Making coiled wicks of cotton cord twisted hard and firm, and gymped or bound together.

3. Plaiting candle wicks on a wire, which is afterwards withdrawn, in order to leave a space for the expansion of the threads, and facilitate capillary action.

4. Metallizing one of the strands of which the candle wick is composed, by immersing it in bismuth.

5. Cross gymping the wicks by passing them once through an ordinary gymping machine, and then a second time in the reverse direction, or through this machine,

which has two flyers and bobbins added, that rotate in opposite directions round the tube through which the wick passes, and cross gymps it on both sides at the same time.

WILLIAM MORRIS, Cold Bath-square, Middlesex, C.E. *For improvements [in the preparing of clay and] in the manufacture of bricks, tiles, and other articles made of clay or brick earth.* Patent dated November 2, 1849.

The patentee, who has disclaimed the portion of his title between brackets, specifies a reciprocating and rotary brick-making machine.

1. The reciprocating brick-making machine consists of a strong framework, in which a carriage slides on rollers fixed on the bed plate. This carriage is moved to and fro by means of a pinion, worked by a winch handle, which gears into a rack fixed to the under part thereof. The sets of moulds are supported by plummer blocks at each end of the carriage, and are, when slightly over-filled with clay, brought under the dies alternately, which are worked by a hand-screw. As one set of moulds is being rammed in with clay, the other is emptied on to boards, supported on springs in carriages.

2. The rotary brick-making machine consists of a cylinder, on the periphery of which are fixed the moulds. The bottoms of the moulds are supported on plungers, which sustain the clay while it is subjected to the action of a die fixed to an oscillating lever, and thrust it out on to carriages, which are supported on springs as before, and run on a circular rail. The lever is worked from a main shaft, which at each revolution moves the cylinder onward the distance of one mould by means of a clawker attached thereto, which acts upon projections fixed to the end of the cylinder.

*Claims.*—1. The mode of working and arranging the moulds.

2. The arrangement of apparatus for receiving the bricks from the moulds.

GEORGE PARK MACKINDOE, Mountblow, Scotland. *For certain improvements in machinery or apparatus applicable to the preparation, spinning, doubling, and twisting of cotton, wool, silk, flax, and other fibrous substances.* Patent dated November 2, 1849.

*Claims.*—1. A mode or system of regulating the twist of yarns in mules of the mangle wheel, or mangle rack class, by means of, or through the intervention of, the mule carriage, the back or front twist pulleys, or the shaft thereof, or by any other mechanism in direct communication with the spindles.

2. The use and employment of an oscillating or vibratory lever for taking in and putting up the carriage, such lever being connected to the carriage, the headstock, or the floor.

3. The use and application of a counterpart to the radial arm and screw employed to wind on the yarn.

4. A mode or system of putting down the faller by an arrangement of disengaging catches or detents.

5. Making the driving or main-power shaft to extend from one extremity of the headstock to the other.

6. The extension or elongation of the cam shaft from the drawing rollers forward to the front of the headstock.

7. A general arrangement of the mule headstock, as described in the specification, and exemplified in the drawings which accompany it, by which great facility is afforded for access to the working parts.

MICHAEL JOHN HAINES, Lucas-street, Commercial-road East, Middlesex, leather-pipe maker. *For improvements in the manufacture of bands for driving machinery, in hose, or pipes, and buffers for railway purposes.* Patent dated November 2, 1849.

1. Mr. Haines proposes to manufacture driving bands of a combination of some woven fabric coated with gutta percha or gutta percha compound and leather. The leather being stitched or cemented, or both stitched and cemented, over the edges to prevent them wearing away, or applied to one or both surfaces of the bands in a similar manner. Instead of a woven fabric, the patentee proposes to use ropes or strands, which are coated, and have the spaces between them filled with gutta percha, or gutta percha compound. In some cases the woven fabric does not extend to the edges of the exterior gutta percha or leather.

2. The improvements in manufacturing hose or pipes consist in coating the leather of which they are composed on both sides with gutta percha, and joining the edges by warming the gutta percha and pressing it together. For this purpose the edges of the leather are bevelled off, and the whole well scoured with an ammonical solution, consisting of 1 oz. of sal ammonia to one pint of water, after which opal dissolved in wood naphtha, or spirits of wine, and mixed with gutta percha varnish, is applied to both sides of the leather.

3. The buffers are constructed in the ordinary way, with the exception that dressed or undressed buffalo hides are employed as the elastic media.

The claims, three in number, refer to modes described of manufacturing driving bands, hose or pipes, and railway buffers.

LUCIEN VIDIE, French advocate, Paris, but temporarily of 4, South-street, Fins-

bury, Middlesex. *For certain new and useful improvements in conveying passengers on land and water.* Patent dated November 2, 1849.

*Claims.*—1. Indicating to passengers the progress and position of conveyances on land by means of certain visible signals, and its application to every kind of vehicle.

2. Indicating to the guards of a train, by means of certain visible signals, the carriage which the passengers want to have opened.

3. Indicating, by means of visible signals, to passengers the progress and position of conveyances on water, and its application to every kind of vessel.

JOHN COWLEY, Walsall, Stafford, merchant; and JOHN HICKMAN, Aston, Warwick, clerk. *For improvements in the manufacture of bedsteads, chairs, tables, couches, and tubular or hollow articles.* Patent dated November 2, 1849.

Among the most noticeable improvements which form the subject of this patent, are—

1. Several modes of effecting the union of parts of iron bedsteads, couches, &c.

2. Making laths of two pieces of iron, with vertical springs interposed between them.

3. A method of ornamenting the legs of bedsteads, tables, chairs, and other hollow articles of metal by casting them with openings, and placing behind such opening velvet or other ornamental material.

4. Opening or shutting a telescopic table by turning a screw which passes through the different frames which support the leaves.

JOHN JORDAN, Liverpool, engineer. *For certain improvements in the construction of ships and other vessels navigating in water.* Patent dated November 2, 1849.

This invention consists in building vessels with an iron frame, composed of bars rolled into the required shape, to which timber planking is attached by rivets or bolts, to form the sides, bilge, and bottoms. The keel-plate is curved at each end to support a timber stem, stern, and stern-post, to which a keel of wood is made fast underneath. The butt-joint, of two planks, is formed by fastening a sheet of iron between it and the frame, and interposing between them a layer of gutta percha, caoutchouc, or other suitable material. In order to protect those portions of iron which are exposed to the action of water from injury, it is proposed to coat them with a combination of gutta percha and black lead.

WILLIAM BUCKWELL, Artificial Granite Works, Battersea, Surrey, civil engineer; and JOSEPH APSEY, Blackfriars, Surrey, engineer. *For improvements in steam engines, and in propelling vessels.* Patent dated November 2, 1849.

The patentee describes and claims—

1. Placing the cylinders in double-cylinder engines in line transversal to the shaft, instead of in the same line as heretofore, and uniting the piston-rods into one. Also employing but one slide valve for the two cylinders, which has a channel or channels cut in it to allow of the passage of steam to and from the boilers.

2. Making stationary steam boilers of less than four feet in diameter and twelve times their length, and employing two or more heated by the same furnace, according to the amount of steam required to be generated, instead of increasing the size of the boiler. The boilers are supported on fire-lumps or bars, and covered in at top with some non-conducting substance. The heating effect is increased by gradually enlarging the space around the boilers towards the flue end, and partially arresting the products of combustion by means of moveable bridges. In the case of marine steam boilers, it is proposed to employ tubular ones, for the purpose of increasing the heating surface, and thereby economizing fuel; and to avoid the liability of the tubes being uncovered from the vessel's pitching and rolling, they are placed vertically. The steam space is increased by the use of a dome top, and other necessary additions.

3. A new propeller, which consists of a conical shaft, having two or more pyramidal or triangular inclined surfaces fixed thereto.

CHARLES COOPER, Southampton-buildings, Chancery-lane. *For improvements in the treatment of coal, and in separating coal and other substances from foreign matters, and in the manufacture of artificial fuel and coke, and in the distillation and treatment of tar and other products from coal, together with apparatus employed for the said purpose.* Patent dated November 2, 1849.

The patentee describes and claims—

1. The purification and separation of coal, by taking advantage of the difference of their specific gravities [by causing the coal to pass through a jogging sieve, which is furnished with a number of partitions composed of perforated metal plates—the perforation of each being smaller than those of the preceding, and having portions of its sides cut away, whereby the different-sized lumps of coal will be shook over into receivers, and the fine dust delivered from the last division. The foreign matters, such as pyrites, may be easily removed by hand from the various collections of coal, inasmuch as they contain no dust, while the dust will be comparatively purified in consequence of the coal being of a more friable nature than the foreign matters.]

2. The classification of coal according to size when in combination with water sifting.

3. The combination of a continuous-acting and classifying water-sifting apparatus for separating coal from foreign matters, and also for separating from each other, substances of different specific gravities. [This apparatus consists of a water-trough, in the upper part of which is a perforated plate to support the coal. The reservoir is divided into two portions by a vertical partition reaching nearly to the bottom. In the smallest of these divisions there is a plunger, which is made to work up and down. An inclined board is supported in the largest division, with the lower end some way beneath the bottom of the vertical partition. The effect of this arrangement is, that each down stroke of the piston will displace the water, and drive it through the perforated plate, and agitate the coal and other matters placed thereon, temporarily holding them in suspension, whereby, when the agitation has subsided, the foreign matters will be found arranged in layers according to their respective specific gravities, and the coal at the top of all, which is subsequently removed as required.]

4 A mode of constructing coke ovens, [which consists in making them shallower and longer than heretofore, with one end larger than the other, and with openings along the centre of the floor, and in the lower parts of the sides, which communicate with flues provided with doors, for the purpose of changing the direction of the currents of air alternately. Both the back and front of the oven are furnished with doors.]

5. The use of a moveable arch or cover to the oven [which may be moved out of the way to allow of its being charged with coal.]

6. Increasing the density of the coke by ramming in the coal [around iron cylinders, which are placed in the oven with their lower ends in the holes in the floor, and, after the oven is filled, withdrawn. The coal is previously damped, and the oven is to be supposed to have been just emptied, so that its heat will be sufficient to ignite the coal, especially near the hollows. The top is put on the oven, and covered over with coke or ashes, and some of the flues are closed, and the rest shut so that the air which enters (say) the holes along the centre of the bottom, will escape through those on the sides, and be conducted to the ovens on either side which will be thereby heated. The current of air through the oven is repeatedly changed by alternately reversing the positions of the doors of the flues; and when the coal has burnt long enough, all the doors are closed to exclude the air, and the coking allowed to finish.]

7. A mode of discharging the coke from the oven [by means of an iron plate which fits the opening in the smaller end, and is forced by means of a screw into the oven, so as to drive the coke out of it.]

8. A mode of extinguishing coke by discharging it from the oven into a close vessel [which is composed of two casings, with water between, and is of about the size of the oven. It is fitted with a door, which is closed as soon as the coke is in; and the steam generated by the heat is conducted into the coke by a pipe leading from the top of the water space, to expel the air and complete the coking operation. This vessel is provided with wheels to facilitate its removal from the ovens to the sheds into which the coke is discharged and stored.]

9. Coking coal by the use of alternating currents of air passed through the coal by channels formed in the coal itself, and communicating with flues.

10. An arrangement for collecting the ammoniacal liquors and surplus tar [which consists in receiving the volatile gases into channels surrounded with water, wherein they are condensed.]

11. A method of distilling tar by the introduction of steam into it, and the partial removal of atmospheric pressure, and in purifying and washing the oil; also in the application of this process to the distillation of naphtha and other products of coal. [The tar is placed in a boiler, and when it is raised to near the point of ebullition, steam is admitted into the midst of the tar through a horizontal pipe, fitted with two rose ends, and connected with the source of supply by a vertical pipe. Ebullition speedily ensues, and the volatile matters are led into a condenser fitted with an air pump, by which a partial vacuum is constantly maintained in it. A vertical pipe rises in the condenser to nearly the top, and opens at bottom into a water reservoir. By reason of the vacuum in the condenser, the water will rise in and overflow the vertical pipe, mingling with the volatile vapours, and condensing them. The oil is drawn off as required, and the water allowed to return to the reservoir.]

12. The general arrangement and combination of the mixer and compresser for making artificial fuel. [The mixer consists of two concentric cylinders placed one within the other. The internal periphery of the outer cylinder, as well as the external periphery of the inner one, are both furnished with scrapers, which prevent the adhesion of the materials (small coal and pitch) to the sides, and being bevelled drive them down. The inner cylinder, which is made to revolve by toothed gearing from the prime mover,

has a fire lighted in it, and the space between the two is filled with the materials. The products of combustion escape under the large cylinder, and passes around it through flues to the chimney. By these arrrangements, the materials are melted and intimately mixed together, after which they are allowed to escape at bottom into moulds, supported in a circular rotating frame, which are fitted with bottoms that are carried on spindles having wheels on the lower part to enable them to travel over a circular rail, concentric with the frame, along with the moulds. The spindles are maintained in a vertical position by guides on each side of the rail. As the frame revolves, it brings the full moulds underneath a rotary endless chain of plates, linked together. At this point the rail is slightly inclined upwards, so as to lift the spindle and the bottom of the mould which it carries, and thereby compress the contents of the latter. After this, the rail inclines downwards to allow of the mould and brick of fuel passing clear of the plates. Subsequently, but before coming under the mixer, the rail again inclines upwards so as to protrude the brick of fuel above the mould and facilitate its removal therefrom by hand to a table.]

William Edward Newton, Chancery-lane, C.E. *For improvements in machinery for dressing, shaping, cutting, and drilling, or boring rocks or stone; part of which improvements are, with certain modifications, applicable to machinery or apparatus for driving piles.* (A communication.) Patent dated November 2, 1849.

*Claims.*—1. The employment of cutters formed of circular metal plates mounted either singly or in sets on a shaft or spindle, such cutters being made to pass over the surface of the substance to be operated on with a rolling motion, so that it will cut away or reduce to the required form any projections thereon. Also the use of cutters, supported on a rotary stock, which act upon the surface by impact, or by striking against it.

2. A combination and arrangement of friction cylinders or drums with a treadle and a barrel, which raise the boring tool by winding the cord. [Two of the cylinders are keyed on the driving shaft, and the other two on the axle of the barrel, which may be moved up by the treadle so as to bring its cylinders into contact with the others and receive rotary motion.]

3. Peculiar arrangements, or any modification thereof, for winding up the cord, as in the preceding case, by means of a drum with a rim and wedge-shaped projection, which, at a certain point, cause the cord to ride off and allow the boring tool to fall.

4. Any modifications of the arrangements embraced under the second and third claims for raising the monkey, or weights in pile-driving machinery.

James Buck Wilson, of St. Helens, Lancaster, rope-maker. *For certain improvements in wire ropes.* Patent dated November 8, 1849.

Mr. Wilson's improvements relate to the plaiting or interweaving of wire ropes, and to machinery employed therein, which would require the aid of engravings to render any description intelligible.

James Combe, of Belfast, Ireland, engineer and machinist. *For improvements in machinery for heckling flax and hemp, and in machinery for producing flax yarns.* Patent dated November 2, 1849.

The object of this invention is to allow of the direction of the action of the heckles being reversed without moving the holders, and to construct the drum which carries the system of heckles in sections.

The claims embrace various constructions and arrangements of the machinery, as described in the specification and exhibited in the drawings.

Alfred Barlow, of Friday-street, London, warehouseman. *For certain improvements in weaving.* Patent dated November 2, 1849.

This invention consists in certain arrangements of parts in a Jacquard machine; of which we shall give a full description, with illustrative engravings, in a future Number.

Adam Cotton, of the firm of John Elce, and Co., Manchester, machine-makers. *For improvements in machinery to be used in preparing and spinning cotton and other fibrous substances.* (Being a communication.) Patent dated November 2, 1849.

Mr. Cotton describes and claims,

1. Certain combinations of machinery for forming a better bobbin than has hitherto been done.

2. The use of a spring for increasing the presure of the presser.

3. The application of vulcanized India rubber to drawing-rollers; and

4. A mode of driving the rim band or pulley which communicates motion to the spindles of self-acting mules.

## RECENT AMERICAN PATENTS.

(Selected from the Reports in the *Franklin Journal.*)

For an Improved Manufacture of Bags and Sacks. *William B. Carlock.*

*Claim.*—Producing a new manufacture of bags, by weaving together two or more warps above, and two or more warps below, to

form two or more cloths, when the weft is carried around from the one to the other, at one or both sides, to unite the two cloths, in combination with the weaving of the two cloths together at given points, to unite them, by weaving together all the warps at given distances, for forming the closed sides or ends of bags.

For an Improvement in Machines for Cutting Veneers from Cylindrical Blocks. *Benjamin S. Stedman.*

This invention relates to improvements on the machine for sawing, by means of a circular saw, veneers from the periphery of a cylindrical block in the form of a volute, and principally intended for the sawing of ivory, in which great accuracy is required in the movements of the various parts.

*Claims.*—1. A reciprocating saw-carriage, in which the saw is operated by a belt from a driving pulley on the main frame, and passing round a guide pulley on the permanent frame, and the guide pulleys on the carriage, in combination with the carriage which carries the block to be sawed, and which has an intermittent motion towards the saw, derived from the reciprocating motion of the saw-carriage.

2. A combination of apparatus for giving the advancing motion of the block towards the saw, with the apparatus which gives the rotating feed motion to the block; but this only when the two are connected together, and derive their motions one from the other, and when the connection between the two is adjustable to vary their relative motions.

3. A combined apparatus for advancing and rotating the block, in combination with the reciprocating saw carriage, by the means described, when the method of operating the carriage is adjustable to various lengths of blocks, and when the said connections between the carriage and the advancing and rotating apparatus are adjustable.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Robert Dalglish, of Glasgow, merchant and calico printer, for certain improvements in printing, and in the application of colours to silk, cotton, linen, woollen, and other textile fabrics. May 7; six months.

Gustave Eugene Michel Gerard, of Paris, France, for improvements in dissolving caoutchouc (Indian-rubber) and gutta percha. May 7; six months.

George Hurwood, of Ipswich, Suffolk, engineer, for improvements in grinding corn and other substances. May 7; six months.

Joseph Gibbs, of Devonshire-street, Portland-place, Middlesex, civil engineer, for improvements in artificial stone, mortar, and cements, and in the modes of manufacturing the same. May 7; six months.

John Tatham and David Cheetham, of Rochdale, Lancaster, machine makers, for certain improvements in machinery or apparatus and operations connected with the manufacture of cotton, wool, silk, and other fibrous substances and fabrics, and in the application of certain materials to the manufacture of textile fabrics. May 7; six months.

George Robbins, of Forrest Lodge, Southampton, gentleman, for improvements in the construction of railway carriages. May 7; six months.

John Youil, of Ardwich, Manchester, brewer, for certain improvements in machinery or apparatus for washing, cleansing, filling, and corking bottles and other vessels. May 8; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| May 4 | 2296 | Francis Drury | Albany-street, Regent's-park | Steel Bell. |
| 6 | 2297 | John C. Else | Albany-road, Camberwell | Beer and spirit preserver. |
| ,, | 2298 | John Holford and Edward Barry Collard | Lord-street, Liverpool | Frame for carpet and other bags. |

## CONTENTS OF THIS NUMBER.

# Mechanics' Magazine,

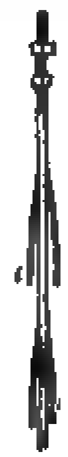
MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1397.] SATURDAY, MAY 18, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## MESSRS. KEELY AND WILKINSONS'S PATENT IMPROVEMENTS IN LOOPED OR ELASTIC FABRICS, AND IN FRAME-WORK KNITTING MACHINERY.

Fig. 1. Fig. 5. Fig. 6. Fig. 2.



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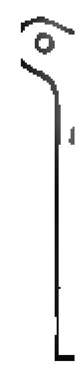

Fig. 8.

## MESSRS. KEELY AND WILKINSON'S PATENT IMPROVEMENTS IN LOOPED OR ELASTIC FABRICS, AND IN FRAMEWORK-KNITTING MACHINERY.

(Patent dated November 10, 1849. Specification enrolled May 10, 1850.)

*Specification.*

*Firstly.* Our invention consists in manufacturing looped or elastic fabrics of several threads, each of a different material from the others, or some of one material and some of a different material or materials, and the whole so woven, knit, or looped together, that any one or two of the threads shall be completely enveloped by the others, and so also that, in the event of a failure in any of the loops, this shall not cause that general running or failure of the entire fabric which results from such failure in the case of ordinary looped fabrics. For example, we make gloves or stockings in this way, composed of three threads—one of cotton and two of silk, in which the cotton thread is interposed between the two silk threads, and both the outside and inside of the glove or stocking are wholly of silk; or we make gloves and stockings of four threads, the two innermost of which are of cotton and the two outer ones of silk. A comparatively cheap fabric is thus made to exhibit all the appearance of a more expensive one, while at the same time, from its being less liable to run, it is proportionately stronger and more lasting than looped fabrics of the ordinary manufacture; by which modifications and additions we are also enabled to weave a number of such articles (or webs) in the same frame at one and the same time, each web having a separate and perfect selvage. We produce these improved articles of manufacture by means of the common stocking frame, with certain modifications and additions which we shall now proceed to describe:—

Fig. 1 of the annexed engravings represents a front elevation, and fig. 2 a vertical section of a stocking frame, as so modified and added to. A is the sinker bar; B the hand bar; $C^2$ $C^2$ the presser bar arms; D D the thumb or locking plates; E E the front hanging cheeks; F the needle bar, and *a a* the needles; G the jack bar, and $G^2$ the jacks. (All the preceding parts, together with the lockers, locker bar, the truck and carriage bar, are nearly similar to those of the old knitting frame, and familiar to all stocking weavers.) H $H^1$ are the lead and jack sinkers, which are separately represented of the actual size in figs. 3 and 4: *b b* are the nibs, which, instead of having, as usual, an acute angular part at $b^1$ for the reception of the threads, are made square, as shown, at the bottom of the notch or angle, so that they may press upon two or more threads, columnwise or parallel to one another, without twisting, during the motions of sinking and locking. J is a rail with bevelled top surface, which is supported from the framework by two arms $j^2 j^2$. K is a carriage, which runs upon the rail J by means of two small cones or wheels *c c*, bevelled to correspond with the top surface of the rail; *d d* are rollers, which serve in front as guides to the carriage K; and *e* is a friction wheel at the back. $K^2$ $K^2$ are two arms which are screwed to the carriage K, so that they may be readily adjusted to any required height, and carry a guide bar $K^3$, which has affixed to it a number of compound guides L, L, L, a front and side view of one of which is given separately on an enlarged scale in figs. 5 and 6. Each of these guides lays in the threads to a separate set of needles, and every separate set of needles and sinkers produces a separate article or web. The upper part of the loom, for holding the bobbins and regulating the supply of threads to the needles, is affixed to the board M, which is mounted upon the framework by the pillars *f f*. N is a box, which holds a set of bobbins *g, g, g*, which are mounted on spindles, as shown. When these bobbins contain silk, the bottom of the box is covered with water, to impart the proper degree of dampness to the silk to enable it to be worked. On the top of the box N is a rail, which carries another set of bobbins *h, h, h*, which are employed for yarns that work in a dry state. O O is a frame of wires for the purpose of guiding the balances or weights *i, i, i*. $P^1$ $P^2$ are levers, which are actuated by the cords *k, k, k*, so that, at the formation of each row of loops, the cross bar Q is made to descend for a certain distance to unwind a sufficiency of thread from the bobbins for the formation of the next row of loops.

The threads from the bobbins in the box N are passed over the first row of crank wires R, R, R, through the balances *i i*; next through a second row of crank wires $R^2$ $R^2$; after which they pass through the guide bar S, and over the steadying bar $S^2$, whence they pass through the brass combs T, T, T (a separate view of which is given in fig. 7) to the compound guides L, by which they are laid upon the needles. The threads from the bobbins outside of the box, after being passed over the cranked wires *u u*, follow the same course which has just been described in reference to the threads from the bobbins in the box N. In the loom represented in the engravings, and which we are now describing, there are four threads passed through each of the combs T T and compound guides L, *l*, *l*, so that the web produced would be formed of four threads, and the positions these threads would take in

respect to one another would be determined by the guides L, *l*, *l*. Thus, supposing it were required to form the fabric with silken surfaces on both sides, the silk threads must be passed through the outermost and innermost holes in the bottom of the guides. The small guides *l*, *l*, *l*, fixed upon the stems of the larger guides L L, are for the purpose of dividing the threads, and keeping them from twisting upon the return of the guides over the needles.

Fig. 10.

Fig. 11.

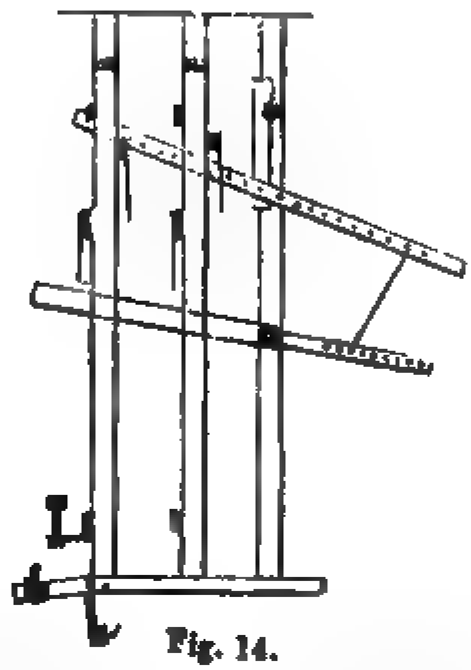


Fig. 14.

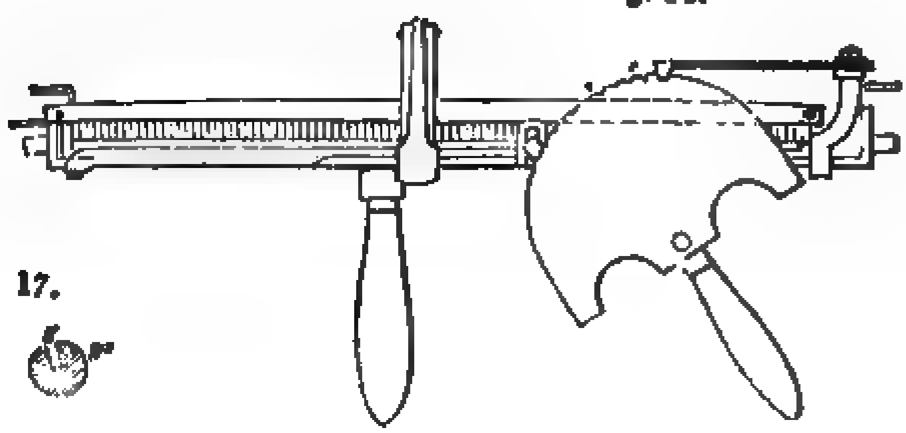

Fig. 9.

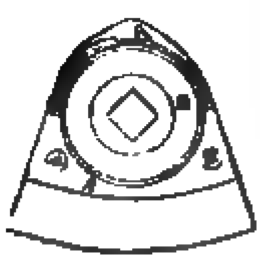

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Fig. 16.

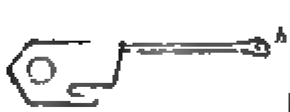



Fig. 8.

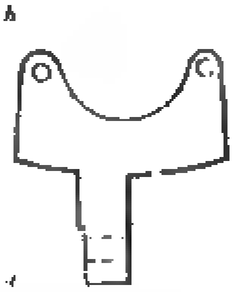


Fig. 12.

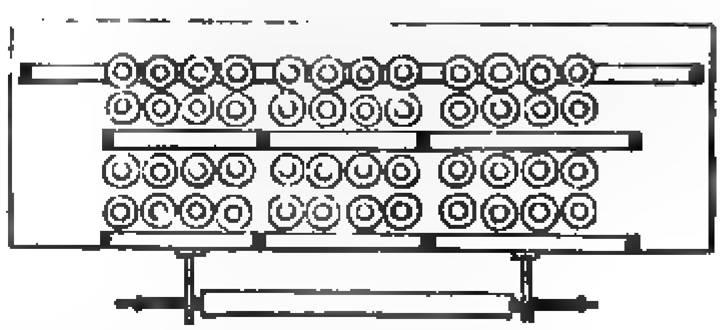
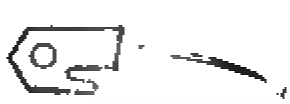


Fig. 15.



In fig. 2 the needles and sinkers are represented as being divided into six equal portions (such an arrangement as is adapted to making the fingers of gloves), but the divisions may be of any desired number—that is to say, of any number which one workman can look to or superintend at a time.

The movement of the carriage K is effected by the side treadles, the same action which strikes the jacks moving the carriage through the medium of the cords *m m*, which are attached to the carriage by the slide-bar V. The first action which takes place on pulling the cords *m m*, by means of the treadle, is to cause the slide-bar V to move forward till the stops, *v v*, come against the guards, $v^2 v^2$, which allows the guides, L L, to get in advance of the falling down of the jacks (were this lead not given to the guides, the action of the machine would be stopped by the sinkers falling in advance of the guides instead of after them). W is a supplementary slide bar to which the cords, *m m*, are attached, when it is found necessary to work the loom and allow the carriage K to stand at rest, as during the operation of throwing in of stripes into a fabric (at which time the thread is either laid into the needles by hand or by mechanism, such as is hereinafter described). Guides may be connected by joints to the carriage bar, $K^3$, so that they may be slid up out of the way to enable the stripes to be varied.

When figured fabrics are to be produced, the figuring, or independent threads as they are called, are warped or wound upon bobbins of the sort represented in fig. 8, which is a front elevation of a counter bar fitted with a number of bobbins and carriages. A plan of a single bobbin and carriage is given separately in fig. 9. The carriages, A A, are all fixed in the counter bar $W^2$ by wires passed through the holes *a a*, the bobbins, B B, being left free to turn as the thread is unwound from them. In figs. 1 and 2, this counter bar $W^2$ is shown as being fitted upon two slotted cranks attached to the woodwork of the frame, and when so fitted, it affords great facility for applying the threads as independent warp threads, so that a single thread, or any number of threads, may be put in or left out to produce the desired pattern.

Bars of bobbins of this description have been before used in manufacture of bobbin net, but the carriages have always in that case been moveable, whereas in our application of them the carriages remain fixed while the bobbins are left turning.

Another mode of throwing into the web plain or various coloured threads for the purpose of making stripes or various patterns is shown in figs. 10, 11, and 12. J is a carriage rail, similar to that represented in figs. 1 and 2, and before described; the stops, B B, for the carriage are prolonged upwards, and the prolongations form supports for a warp roller R, upon which any number of different threads may be warped. The threads from this roller are supplied to the needles by the carriers affixed to the carriage (which are for this purpose passed down through the combs T T.) This arrangement is not intended to supersede the use of a fixed bar of bobbins, but to enable different colours or qualities of threads or yarns to be used either at separate times, or at one and the same time, along with the bobbin threads.

It will be observed that in the figures last referred to (figs. 10, 11, 12), the arrangements at the head of the loom are such as would be suitable for the supply of twelve guides with threads, each carrying four threads, whereas in figs. 1 and 2 the arrangements made are for the supply of only half that number.

To produce raised lace patterns upon gloves, stockings, and other like articles, we adopt a jack of the peculiar construction represented in fig. 14, which is a back elevation of the same. Hitherto jack-machines have only contained a series of "points" for the purpose of lifting the loops from one needle to another in the production of figures. But it is necessary for the object of this part of our invention that the jack should be fitted with "guides" as well as "points," so that we may be enabled not only to lift the loops, but to throw in independent, or figuring threads, at the same time. *a a* are the points, *b b* the guides which are shown separately in figs. 15, and 16; *c c* are "gates," as they are technically termed, so arranged that the traverse given to the "points" and "guides" may move, "half gates" as well as whole gates, so that they can be made to pass through the needles as well as bring the points and guides into action; and both points and guides are capable of being turned into an upright position, whereby the whole, or any number, of either the guides or points may be put out of action while the others are left to act upon the web, and so produce the desired pattern. We produce also by the peculiar jack-machine, just described, looped lace gymps in large numbers at a time, and either all plain, or some plain and some figured, and when figured, of diverse patterns. At present such gymps are made by hand, one at a time, and plain only.

To raise a pile upon framework knitted fabrics, we add to the jack with points and guides, just described, and immediately under the needles, a rod of wire, $R^3$, of the form represented in cross section, fig. 17. The loops thrown in by the thread from the jack, are made over the wire or rod, and a circular knife or cutter being made, by the action of the loom, to travel along a longitudinal groove, $b^1$, cut in the side of the wire or rod, it cuts the loops through, and forms a cut-pile knitted fabric.

(*To be continued.*)

## THE EFFECTS OF MACHINERY ON THE WELFARE OF THE LABOURING CLASSES.

(Continued from page 356.)

We have seen that the market for manufactures is *limited* by the sum which the public has in its power to spend on manufactured articles. So long as the income of the purchasing body is limited, so long is it impossible for the manufacturer to sell an unlimited amount of his goods at a remunerating price. He might go on exchanging his produce with *other* manufacturers, were it not that here the limited supply of food steps in and stops production by the want of the food necessary to the life of the operative. If *no* human hands were required in a manufacture—if an automatic machinery could produce the article by itself—then of course there would not be even this limit to an indefinite increase of the goods, and an eternal exchange of them for other goods similarly produced.

But if the market for all goods is thus *limited* by the ability of the purchaser—on the other hand, so long as his ability remains the same, so long as the income of the public disposable for purchasing manufactures remains undiminished, so long the manufacturing interests *on the whole* will not be injured, even though some branches may. Thus, though the cotton manufacture should be destroyed, the income of the rest of the public would remain uninjured, the only effect would be that this income would now be expended on *some other* branch of manufacture, such as the woollen, silk, &c., and the hands thrown out of employment in the cotton trade would find employment in the other branches. There would be a temporary evil, but not a permanent one; except so far as the public might suffer, by the loss of cotton articles to which they had been accustomed. And this, I think, is the main reason why machinery does not throw any hands, *permanently*, out of work: namely, the fact—that if one sort of goods become cheaper, the money thus saved to the purchaser will be spent on some *other* class of goods, to the manufacture of which the discarded hands may turn. Mr. John Stuart Mill, in his "Principles of Political Economy," has opposed to this very plain and obvious consideration an objection, which I cannot help wondering at in so able a writer. I will quote his words. (Book I., chap. vi.)

"All attempts to make out that the labouring classes, as a collective body, *cannot* suffer by the introduction of machinery, or by the sinking of capital in permanent improvements, are, I conceive, necessarily fallacious. That they would suffer in the particular department of industry to which the change applies, is generally admitted, and obvious to common sense; but it is often said, that though employment is withdrawn from labour in one department, an exactly equivalent employment is opened for it in others, because what the consumers save in the increased cheapness of one particular article, enables them to augment their consumption of others, thereby increasing the demand for other kinds of labour."

This last clause appears to me, as I have just said, to be a sound argument: but what says Mr. Mill?

"This is plausible, but, as we saw in the last chapter, involves a fallacy; *demand for commodities being a totally different thing from demand for labour.*"

This last assertion, that "demand for commodities is a totally different thing from demand for labour," appears to me one of the strangest assertions ever seriously made by a man of sense; and I cannot even imagine by what ingenuity or dexterity Mr. Mill can make out even the semblance of truth in such an assertion. Demand for goods *not* a demand for labour! To such an assertion it seems abundantly sufficient to answer, that as goods cannot exist without labour, demand for one must necessarily be demand for the other. Such an assertion amounts, in fact, to saying, that if from henceforth all demand for goods should cease, labour would go on the same as ever—or, that if all shops were emptied of their goods, by purchasers, as fast as filled, all this would not give the slightest demand or encouragement to labour! I have given the most careful attention to Mr. Mill's work, and especially to the part in which this extraordinary proposition occurs; but I cannot, "for the life of me," make out on what grounds he defends it. In the work of an inferior writer, such a strange notion would not deserve the trouble of inquiring about, or any attempt at understanding the author's reasons for it; but occurring in so excellent a work as this of Mr. Mills, it seems altogether unaccountable. That the

reader may have the benefit of catching any glimpse of the author's reasons, I shall finish the quotation of the paragraph:

"It is true the consumers have now additional money to buy other things, but this will not create the other things, unless there is capital to produce them; and the improvement has not set at liberty any capital, if even it has not absorbed some from other employment. The supposed increase of production and of employment for labour in other departments, therefore, will not take place; and the increased demand for commodities by some consumers will be balanced by a cessation of demand on the part of others, namely, the labourers who were superseded by the improvement and who will now be maintained, if at all, by sharing, either in the way of competition or of charity, in what was previously consumed by other people."

Mr. Mill's meaning in the last part of the paragraph, appears to be this. The money saved by the purchasers of the cheapened article, though ready to be laid out in the purchase of other things —"will not create the other things, unless there is capital to produce them." *But this money, thus saved, will become the capital thus wanted.* And here, if anywhere, I think I detect what it is that has led Mr. Mill to his strange assertion above-mentioned. It is very true, that goods cannot be produced, and labour maintained, without capital. It is equally true, that the money which I *spend* is not, in itself, and in that stage, (so to speak) *capital!* but it *replaces* capital, and is therefore equivalent to capital. Suppose I save ten pounds a year by the cheapening of cloth goods, effected by machinery, and through which a hundred men have been discarded from the cloth-manufactures; I wish to spend this ten pounds on something else, some other kind of goods, say shoes. Can I not employ some of these hundred men, who are out of work, to make me ten pounds worth of shoes? "No!" says Mr. Mill, "Your ten pound saved *is not capital*, and without capital the shoes you want cannot be made." But I say that *it is capital;* not perhaps in the usual form in which manufacturing capital exists—but still "capital," to all intents and purposes—and able to perform the functions of capital in maintaining shoemakers, or any other kind of labour that I choose to employ.

The usual process, on a large scale, would be this: The money saved would be sent to the bank, and the banker would thereby be enabled to increase the trading capital of other branches of manufacture, or to furnish capital for the opening of a new branch. In either case a field is opened for the employment of that labour which has been discarded and superseded in the first branch.

The argument, therefore, I have stated above, and which we have thus seen alluded to by Mr. Mill only to controvert it, is a sound and incontrovertible one; and the fallacy is Mr. Mill's. "But," it may be said, "the money thus saved, may be spent in goods which, unlike shoes, are themselves the produce of machinery; and so it may turn out, that instead of employing the labour of a shoemaker with the ten pounds, you spend it on some new branch of manufactured articles which require very little human labour, and do not afford employment for all, if any of the dismissed operatives from the first manufacture." Granted: What is the consequence? Suppose I do spend my ten pounds, say on silk goods, instead of on shoes—and suppose, further, that the increased amount of silk goods thus rendered necessary may be produced by machinery, without *any* new hands being required. [In reality, the increased supply would require increased number of hands in the silk manufacture, and some, if not all, the dismissed cloth-workers, would, or might find employment in this other branch of manufacture, until perhaps improvement in the silk machinery drove them away from this, as it did from the cloth manufacture. But we take the most unfavourable case for our argument.] If *new machinery* be required —even though fresh hands be not necessary to work it—here we have, at once, an opening for the employment of *some* at least of the discarded operatives. "But if neither new machinery nor new hands be wanted, for the increased supply of silk goods—what then?" Why then my ten pounds becomes clear gain to the silk manufacturer (less the price of the raw material, which obviously goes to support and employ labour), who will have it in his power to employ labour with the ten pounds (or the ten pounds, *minus* the price of the raw material),

just as I had, and so on, through whatever successive hands it may pass. But let us consider the case (which is by far the most probable and likely to occur in real business), in which my ten pounds is spent on some article, the production of which is the joint result of machinery and human labour; as, for instance, the silk goods would be. Here, then, we have at least an employment and a support for *some* of the operatives. But whether the *whole* of the dismissed cloth-workers will be wanted to produce the increased supply of silk for me and all the rest of the public, or only a part, will depend on the proportion in which the two elements—hands and machinery—enter into the silk manufacture.

And, here, we come upon the subject of "fixed and circulating capital," which we must therefore examine. Most of your readers are, no doubt, familiar with these terms: it may be sufficient to say, that by "fixed capital," is meant such things as machinery, warehouses, tools, and implements, &c., &c., and by "circulating" capital, the amount paid in wages, in raw materials, &c., the latter kind of "capital" being consumed in the course of the manufacture, and having to be replaced out of the sale of the exact quantity of goods which they make; whereas the machinery, warehouses, &c., need not be replaced, or their cost reimbursed out of the sale of the goods produced during the same period.

The following extract is from the article "Machinery" in the "Cyclopædia of Political Knowledge" (a re-publication of articles from the *Penny Cyclopædia* of the Useful Knowledge Society).

"Suppose a man to have a capital of 10,000*l*., which he is expending annually upon labour in a particular trade, and that his profits are ten per cent., or 1000*l*. a year. Each year his whole capital is expended, and his means of accumulation are thus restricted to a portion of his annual profits only. But let him invent a machine to facilitate his business, and his position is immediately changed. If this machine should cost 5000*l*., and the other 5000*l*. be still expended in labour, he may be said to have saved one-half of his entire capital in a single year; for instead of spending the whole of it, as before, in labour, he is possessed of a durable property, which, at a small annual cost, will last for ten, or probably twenty years. Nor can it be said, that this saving is effected at the expense of labour; for the owner of the machine is placed in a new position in respect to his profits, which prevent him from securing to himself the difference between the amount paid now, and that previously paid for labour. To gain a profit of ten per cent, it had been necessary for him, before the invention of the machine, to realize 11,000*l*. annually, being his whole capital and the profit upon it: but now, in order to obtain the same profit, it is sufficient if he realize 6,500*l*. only: viz., 500*l*. profit upon his fixed capital of 5,000*l*.; and 500*l*. for repairs and wear and tear, calculated at ten per cent.; and 5,500*l*. to replace the sum spent upon labour, with a profit of ten per cent. He would realize the whole 11,000*l*. as before, if he were able; but he is restrained by competition, which levels the profits of trade. For some time he will most probably obtain more than ten per cent. profit, and so long as he is able to do this, his means of accumulating fresh capital in addition to his machine, will be increased, which capital will be expended upon additional labour. But when his profits have been reduced to their former level by competitions, society has gained in the price of his goods 4,500*l*. a year, being the difference between 11,000*l*. formerly realized by him, and 6,500*l*. his present return. But is this amount, thus gained by society, lost to the labourer? Unquestionably not. As a consumer he participates in the advantage of low prices, while the amount saved by the community in the purchase of one commodity, must be expended upon others which can only be produced by labour. It cannot be too often repeated, that all capital is ultimately expended upon labour; and whether it be accumulated by individuals in large sums, or distributed in small portions throughout the community, directly or indirectly it passes through the hands of those who labour. If a manufacturer accumulates by means of higher profits, he employs more labour; if the community save by low prices, they employ more labour in other forms. So long as the capital is in existence, it is certain to have an influence upon the general market for labour."

There are some important considerations, however, absolutely essential to be taken into account, before any decision can be come to on the effects of "fixed," as distinguished from "circulating" capital on the working classes, to which the writer of the above article has not adverted: to these we shall next proceed.

A. H.

(*To be continued.*)

## TUBULAR BRIDGES.

Sir,—As far as my professional engagements will allow, I have been directing some little consideration to the construction of the Britannia Tubular Bridge over the Menai Straits, and have come to the conclusion that a modification of it might be most advantageously employed in the formation of railways and common roads, for crossing deep rivers, ravines, &c.

Like many other great improvements, the tubular bridge is extremely simple, each passage or roadway being nothing more than an immense girder, which is made hollow for the double purpose of rendering it light, and allowing the trains to pass through it—or rather, I might say, singular as it will no doubt appear, the girder is made hollow for the purpose of diminishing the weight, and advantage has been taken of the circumstance to admit the trains through it.

Now the plan I propose is, to adopt the girder principle *altogether*—that is, to construct a girder of an iron framework, in which the several parts should be connected together with angle pieces, and the whole covered with boiler plates, in precisely the same manner respecting matters of detail that Mr. Stephenson, with the intelligent and truly valuable assistance of Mr. Fairbairn, has erected the tubes of the Britannia Bridge.

The depth, however, I propose to give to the girder, would not be uniform throughout its entire length, as is the case in that bridge, but would be greatest in the middle, and be somewhat diminished near the points of support according to the most approved form of the more modern girders. In this way a great saving of material would be effected; there would consequently be a corresponding diminution of weight without losing one *iota* of available strength. So that the integral parts composing the girder might be proportionably reduced in dimension, as it is clear that they would have less to support.

Girder bridges might in this way be constructed much more economically than could have been at first supposed. Nor would the advantages of this form of girder be limited to a saving of expense, as I propose to make the roadway on the upper surface of the girder, passing over it by two slight inclines meeting together and attaining their *maximum* height at its centre, so that trains, traffic, &c., would *go over* the girder, instead of *passing through* its interior. This arrangement would have all the advantages of the new system as far as strength is concerned, while it would obviously be much more agreeable to travellers, who would thus be enabled to admire the country, which is generally well worth seeing in localities where such viaducts are required, instead of being excluded from the light of day, and doomed to imprisonment in the interior of a smoky tunnel. In making this suggestion through the medium of your widely-circulated periodical, I cannot conclude without saying that, in so doing, I would not wish to be supposed for a moment to undervalue the indefatigable labours of Messrs. Stephenson and Fairbairn, which have been crowned with such splendid success in the erection of a gigantic monument which may fairly be considered as the greatest wonder of our age; on the contrary, I look upon them as additional links in the chain which will connect past and present discoveries with future improvements. In these days of railway speed and telegraphic dispatch, we cannot remain stationary for any length of time, and therefore, whenever a movement has been made in advance, the impetus carries us still further forward. Mind has its *vis inertia* as well as matter, and when both are set in motion in the same direction, it is difficult to say into what improved *paths* it will lead us: for who will venture to affirm that we have arrived at the *ne plus ultra* of perfection? Every progressive advance, then, made in the right direction, is so much gained—it is an additional portion of the road constructed, which enables us to proceed further on our way; but we have not yet arrived at the goal.

I am, Sir, yours, &c.,

Wm. H. V. Sankey,

Civil Engineer.

Royal Hibernian Hotel, Dublin,
April 20, 1850.

THE PORTLAND HARBOUR OF REFUGE.—OPINIONS OF SIR SAMUEL BENTHAM ON THE COMPARATIVE EFFICIENCY OF NAVAL AND MILITARY ARMAMENTS.

The petition presented by Lord Portman to the House of Lords on the 25th ult., relative to the works now executing off the Isle of Portland, asserts that the defences intended are not sufficient for the protection of the Harbour of Refuge. Their sufficiency or insufficiency seems to depend materially on a question that has been but little considered—namely, whether our harbours and our coasts can be most effectually and most economically protected by military works on land, or by "the wooden walls of old England?" But whether by the one or by the other, as the sufficiency of the defence and the moderateness of its cost depend either on engineering skill or naval architectural talent, the question appears to be a suitable one for discussion in your columns.

Captain Sir T. Hastings, President of the Commission, in 1844, appointed "to investigate the state of defence in which the naval arsenals were placed at that time," made this statement to the Select Committee of the House of Commons, 1848, on the part of the Commission:—"We came to the conclusion, after much consideration, that it would be desirable and wise to protect the principal naval ports, and to give such a defence to the principal commercial depôts—three or four of them—as would prevent any incursive attack; but when we considered the totally defenceless state of the coast in general, we thought it would be desirable and wise that the protection of this country should rest *principally* on *maritime* defence;"* and further—"We consider that a provision of ships, propelled by steam power and screws, would be made at a much smaller expense than any ordnance works could be prepared to give equal security to the localities I have spoken of, namely, Stokes' Bay, Southampton, the Isle of Wight, and the Island of Portsea."† By his answers to subsequent questions, it further appeared that the Commission recommended steam guard ships for the defence of places other than those above mentioned; and he afterwards added—"looking to our *maritime* superiority as the *real* defence of the country."

Sir Samuel Bentham, though he also considered it to be prudent that our *great* arsenals should be protected by ordnance works, was yet convinced that *maritime* defence was the surest and the cheapest for them, as well as for our minor ports and for the whole line of our coast. He himself had obtained his rank of brigadier-general in *land* service, and was thereby the more competent and the more impartial judge of the comparative efficacy of land and maritime defences on a sea-coast. His communications with First Lords of the Admiralty on the subject of coast defence were many, but, on political grounds, were mostly verbal. Several of the notes and observations are, however, still extant which he had made for his own use; they are generally detached, but in the following selection of them, although his own impressions have been retained, an attempt has been made to give them a certain degree of order in their sequence:—

"The question of the protection of our coasts and harbous—as whether by fortifications on land or by a naval force—is of a military nature, subject to all the political discussions respecting the land and the naval force of the country; but the elements on which a decision might be grounded seem resolvable into the cost of the defence, the comparative efficiency of the different modes of protection, and the collateral advantages derivable from them respectively.

"In a country like Great Britain, which cannot be attacked but by sea, but which is vulnerable along the whole of its extensive coasts,—a country, the commerce of which extending to all parts of the world, requires for its protection an immense naval force,—it is a force of that description that can most economically as well as safely be looked to for the protection of its shores. At that awful period—if ever it should arrive—when an enemy might have made good a landing, and overcome our land forces in the vicinity, fortified places might here, as on the continent, afford places of safe retreat for our discomfited troops; land fortifications may also be considered as not

* Query 9762. † Query 9765.

a superfluous precaution to be taken in regard to our great naval and military arsenals; but for harbours and roadsteads where ships are to lie, ships afford the most appropriate protection.

"As to cost, considering ships* simply as barracks, they might be constructed and kept up at a less expense than an equal amount of accommodation for men in a fortified place; although less sleeping-room might be allotted to each man afloat than would be provided in barracks on shore, yet by appropriate means of ventilation, the floating barrack might be more airy and wholesome than a larger space in a building on shore. As such floating barracks would not, however, afford much room for military exercise, they would, of course, be placed contiguous to a wharf, and troops could repair for exercise to a parade on land: there need to be no greater delay or difficulty in going to and fro for meals or exercise than in going to and fro to buildings on land. The cost of artillery on board ship would be materially less than an equal amount of it in a fortified place on land; the floating barrack being itself the fortification, the outlay for masonry or earthwork in land fortifications would be wholly saved. The annual cost to the nation of ordnance works is never taken into account—no more in this instance than in any other, where the interest of money sunk in a work has to be paid half-yearly, now and for ever.

"As to the comparative efficiency of a fort and of a floating armament for the protection of ships in a harbour, the fixed fortification, however well designed, can only protect the space within the range of its guns—all beyond is open to the enemy; while all within the harbour is exposed to the fire of our own artillery should, by chance, any adverse vessel have effected its entrance to the harbour, so that on such an event the fire of the fort must cease. The floating armament, on the contrary, being locomotive, can proceed to any point that may be attacked; a long line of defence may be formed by its means, or its whole force can be concentrated to repel any formidable demonstration. Nor should it be forgotten, that it is not only the absolute safety of merchantmen in harbour that should be looked to—the people should be saved the horrors of immediate warfare. Floating fortifications, on the approach of an enemy, can go out to sea and combat the invading enemy, ere he approaches a harbour's mouth. A ship, too, can choose its position, so as to bring its guns to bear upon an enemy on different sides, or at different points and distances; whereas from a fixed fortification, the position of its artillery and its range are limited.

"But the collateral advantages of a floating fortification are the most important. Supposing ordnance works to perfectly protect a harbour, their usefulness there ceases, whilst the services of floating fortifications have no limit but want of water to float a sea-going vessel. If danger be at home, vessels to protect us may be kept on our own shores, and at any part of them most requiring protection; or those vessels may be sent to combat an enemy on the open sea, or to destroy his armament in his own ports. Nor does the general usefulness of floating fortifications terminate with defence of home: if not wanted for such service, they are competent to that on foreign stations. Vessels that we possess already, are, many of them, suitable for this diversity of employment, though it must be admitted that our vessels of war are susceptible of great improvement."

In compliance with the recommendation of the Commission to inquire into the state of the national defences, ships of the line and frigates have been fitted with steam apparatus and screws for the protection of the harbours in the Channel; the expense of the alteration was enormous—that of the Blenheim about 63,000*l.*; and it has been asserted that by the alteration she has been spoilt as a sea-going vessel. But it was a different description of vessels that Sir Samuel was

* The term ship, strictly speaking, is applied only to certain of the larger descriptions of navigable vessels; but there not being any short name inclusive of all navigable vessels, the term ship is used in this paper as comprehending seagoing vessels of every description.

so anxious to see introduced for coast defence, namely, those of a shallow draught of water, but armed with artillery of great calibre. The expediency of this measure rests on a fact which but by him has been little adverted to in arrangements for coast defence, namely, the great length of our coast, and the number of our harbours where only vessels drawing but little water can approach. In his letter to Earl Spencer, January, 1798,—a time when a French invasion seemed imminent, and when it was threatened to be by small craft, his second query ran thus:—"In some parts of the coast, and in the small ports situated between the large ones, is not the shallowness of the water such as to indicate the expediency of arming small *shallow* vessels, and employing them for the protection of those intermediate points which cannot be attacked by any other but by small vessels, and where even our sloops of war cannot approach for the purpose of defence?" His eighth query was—"Does not the efficacy of the mass of our naval force depend (*cæteris paribus*) partly upon the destructiveness of the shot it is employed to discharge, partly on the promptitude with which the vessels of which it is composed can be brought to act, upon any part of the coast on which an attempt happens to be made?" His ninth query—"Among all those small ports, such as Yarmouth, Ramsgate, Dover, &c., is there any one that would not admit of vessels capable of mounting carronades of *any* calibre?"

Throughout Sir Samuel's official correspondence on naval armament, his publications, and the manuscripts he has left, it is exhibited that shallowness of draught of water is the quality which most renders a vessel of war suitable for the greatest variety of purposes, and that that quality does not prevent a vessel from being armed with artillery of the most destructive kind; he knew, from his own experience at Otchàkoff, that shallow vessels, so armed, were competent to the destruction of ships of the line brought by the enemy against a fortified place;* consequently that they might be depended on for the protection of our harbours from attacks by sea: besides this kind of service, he considered that it is shallow vessels only, that can protect the multitude of cottages and noble mansions that enrich and embellish the land along the whole length of our shallow coasts. Since the introduction of steam navigation, he conceived, too, that hostile attacks are much more likely to be directed against our lesser ports and harbours than against the great ones; so that, looking to coast defence in general, a given sum of money expended for the production of powerfully-armed vessels; would be infinitely more effective than if sunk in ordnance works.

A measure which, from first to last, he never wearied in advocating, was that of arming vessels with ordnance of *large* calibre. It has of late been adopted to a great extent, but without adverting to his many official representations on the subject. The construction of our vessels of war has been improved, too, by the fundamental principles of mechanics having been better attended to than formerly; but there seems room still for great amendment in this respect, so that the talents of your mechanical readers generally might be turned to good account by pointing out how the parts of a navigable vessel might be most scientifically combined. It is, however, the adaptation of a vessel of war to the performance of the greatest possible variety of services that offers the widest field for improvement, and for the exercise of superior observation, reasoning, and skill.

The following indications of some of the qualities desirable in vessels of war, are extracted from Sir Samuel's manuscripts, and from his published though unattainable works. These desiderata are far from a complete enumeration of the qualities desirable, but they may serve as a skeleton to be filled up by some one of the present day.

"In investigating the general efficiency of the vessel of war" * * * "it seems necessary to note the several services which may be required from vessels subservient to warfare:—

* See "United Service Journal" 1829, Part II., p. 332. The flotilla which Sir Samuel had fitted out, and which consisted of small craft and pleasure barges for river navigation, but which he had armed with ordnance "throwing shells, carcasses, and shot of the largest size," took one Turkish ship of the line, including which, eleven ships of the line were that day taken, sunk, burnt, or destroyed by his flotilla.

"1. Distressing the enemy on his own coasts, in his own ports, harbours, or interior waters, or on the open sea.

"2. The defence of the country against hostile attacks.

"3. Distressing the enemy by taking his commercial vessels, or by preventing the navigation of them.

"4. Protection of the commerce of our own country.

"5. Preventing contraband trading.

"6. The conveyance by sea of the *personnel* and of the *materiel* required either for land or naval warfare.

"7. The conveyance of stores to or from foreign parts, or to different points of our own shores.

"8. The conveyance by sea of non-military persons.

"9. The transmission of orders or intelligence.

"The desiderata in a vessel of war are:—

"1. Warlike force.

"2. Accessibility to all places to which navigation can be extended.

"3. Power of locomotion.

"4. Form best suited to locomotion.

"5. Spaciousness for stowage, and for the accommodation of the *personnel*.

"6. Dispatch in preparation of the vessel itself when wanted for service, and in bringing it into the circumstances most favourable for action.

"7. Readiness at all times for action.

"8. Strength of structure.

"9. Protection against an enemy's shot to the hull, to the men, to the means of locomotion.

"10. Continuance of efficiency from the durability of the component parts of the vessel and its equipment.

"11. Power of long-continuance on a station without having recourse to a port for repairs or for supplies.

## PHILLIP'S FIRE ANNIHILATOR.—RECENT EXPERIMENTS.

Sir,—Three somewhat notable experiments have been recently made with the (so-called) *fire annihilator*, the result of which it is desirable to place on record in your pages, confirming, as these experiments do, in a very remarkable manner, the opinions expressed by some of your correspondents, of the very limited usefulness (or uselessness) of this so much be-puffed invention.

It having been determined to give Mr. Phillip's annihilator a fair trial at Trentham, the seat of his grace the Duke of Sutherland, a temporary erection was made in the park for that purpose, and furnished with a proper store of combustibles. In order that no mistake might mar the matter at the meeting, a rehearsal was had in the morning, on which occasion the annihilator proved inefficacious, owing, as it was said, to the operator going to the leeward of the fire, a stiff gale blowing at the time. In the afternoon, the grand display came off in the presence of numerous spectators, but the annihilator again proved unequal to the task assigned to it, and the Trentham *fire-engine* was called in to finish the business.

Another experiment came off at the Great Western Railway station, in consequence of its having been proposed to furnish the guards with annihilators for the purpose of extinguishing fires in trains. Previous to giving an order, however, a demonstration was demanded, and a truck was loaded with packing-cases, &c., to represent a truck of goods in transitu, and ignited; the annihilator was discharged upon the burning mass in vain, not the slightest effect being produced upon the flames; and the railway *fire-engine* was eventually set to work to extinguish the fire, which it soon did.

The most important experiment, however, was made at the West India Docks, in presence of several of the Directors and dock-officers. A large shed had been erected and filled with old wood, &c., well calculated to make a "good fire." In this case the small portable annihilators were not employed, but a large two-wheeled machine of great capacity, built by Messrs. Deanes for street use, and which was supposed to be capable of annihilating a conflagration of almost any magnitude by merely looking at it.

Upon this occasion, however, the fire-king abundantly vindicated the majesty of his law, for a respectable fire being kindled, the two-wheeler was wheeled up, and commenced discharging a large body of gas upon the flames, "but they didn't mind it a bit;" perhaps it was laughing gas, for the fire laughed at the annihilator—and not only that, it took hold of it and shook it, and but for the dock *fire-engine*, the annihilator would have been "annihilated." One of the Directors afterwards observed, "I have now more

faith in water than ever—and none in smoke!"

If Mr. Phillips possessed the slightest practical knowledge of the subject, he would never undertake such experiments as these, knowing that he stands *no chance in the open air*, where the rapid dilution and dispersion of the gas—independent of the action of a gale of wind, or the immense draught always created by a large fire—renders it impossible to extinguish fire in such situations.

I am told that permission has been given to Mr. Phillips to place his annihilator upon the fire-escapes of the Royal Society for the Protection of Life from Fire, which are first at almost all nightly fires; as also to place an annihilator in charge of his own man upon the West of England fire-engine, all which offers of *practical application* he has (I think unwisely) declined, thereby showing great want of confidence in the capabilities of his much vaunted plans.

I am, Sir, yours, &c.,

ANTI-COMBUSTIBLE.

May 9th, 1850.

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## THE HOLYHEAD AND DUBLIN STEAMERS.

*Total number of Miles ran by each of the Holyhead Steam-ships, Banshee, Caradoc, Llewellyn, and St. Columba, since the day of Launch to May* 11, 1850, *with the average speed of each*:—

| | Commenced. | Miles. | Average speed. | |
|---|---|---|---|---|
| Banshee..... | January 5, 1848 .. | 42,000 | 16 miles per hour. | |
| Caradoc .... | April 4, 1848 .... | 27,300 | 14·2 | do. |
| Llewellyn .. | May 3, 1848...... | 28,500 | 15·5 | do. |
| St. Columba.. | Mar. 1, 1848...... | 36,600 | 14 | do. |

The miles run include trial trips, passages round, and trips on the Liverpool station.

LN.

Dublin, May 14, 1850.

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## DISCUSSION ON RAILWAY AXLES, AND ON THE STRUCTURAL CHANGES WHICH IRON IS SUPPOSED TO UNDERGO FROM VIBRATION AND CONCUSSION.

(From Proceedings of the Institution of Mechanical Engineers, April 24, 1850.)

The CHAIRMAN then said the adjourned discussion* on railway axles and the fracture of iron would be opened by reading a few additional observations by Mr. J. E. McConnell.

### *On the Deterioration of Railway Axles.*

In opening the discussion on railway axles, adjourned from the last meeting, it will be only requisite to refer to the former papers that have been laid before the Institution on the form of axles and their deterioration from work.

1st. As regards the proper form for a railway axle, the proportion was shown in which the diameter of the axle should be reduced from the back of each wheel towards the centre, so as to obtain an equal strength throughout the length of the axle, to resist the strains or blows to which it is subjected. This was tested in two different ways, in the one case by a steadily increasing pressure, and in the other by the blow of a weight of 17 cwt. falling 9½ feet; the force in both cases being applied at the same point—namely, at the outer end of one wheel whilst the opposite wheel was fixed. The result given by these tests was, that the axle, when shaped in the proportion ascertained by previous calculation and experiment, was bent into a nearly uniform curve, showing that the object of obtaining an equally proportioned strength was practically accomplished. It may be observed also, that the general experience of practical engineers engaged in the management of railway rolling stock appears to confirm this principle.

2nd. As to the deterioration that takes place in axles, and the change in structure caused by the course of working, several cases were instanced, and specimens were laid before the Institution of broken railway axles, showing the crystalline appearance of the fracture. The writer considered that a change was produced from a fibrous to a crystalline structure by the effects of the concussion or jarring that the axles are subjected to whilst running on the railway; and it appears to be generally considered that such change takes place to a greater or less extent according to the circumstances, both in railway axles and in many other cases where iron is exposed to

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* For the preceding paper of this discussion, see *Mech. Mag.*, vol. Li., page 465.

concussion or jarring, though there may be a difference of opinion as to the cause of the change. Another striking instance of the conversion of tough wrought iron into a brittle material is shown in the chain slings used for carrying the bars during the process of hammering at a forge: the writer lately had an opportunity of observing a chain which had been in use for this purpose, and had become so extremely brittle, that it was more like glass in its texture than the tough strong iron which it had been when first made, and he was satisfied that it had only been subjected to this extreme jarring action for a few months, and had not been otherwise employed. And further, it may be mentioned as a circumstance of common occurrence that the porter-bars that are attached to the blooms whilst under the forge-hammer, became so brittle with the constant violent jarring to which they are subjected, that they break in two after a very moderate amount of work: in these instances there appears to have been no cause but the jarring or concussion to produce the change, as the iron was subjected to little strain in proportion to its strength; and the same may be observed of several of the instances mentioned before, in one of which the wrought iron arms of a fly-wheel were jarred loose in the cast iron rim, and broke off quite short from the rapid and continued violent shocks caused by the cam striking the helve, although the iron was of the toughest description originally.

In railway axles there can be no doubt that the same action of jarring or concussion is in force, and may produce corresponding effects upon the strength of the iron; and that point at the back of the wheel where the effect of the jarring is concentrated will be most sensibly changed. The action of bending a piece of iron backwards and forwards will, doubtless, result in its fracture at the weakest point, if it be carried on long enough; and it becomes necessary, therefore, with a given weight of material in an axle, to proportion the strength at every point of its length, so that it may be capable of resisting the breaking force equally throughout, the strength being proportioned so as to cause it to yield as uniformly as possible at every point.

A badly proportioned axle, which was completely unyielding in the centre, would be more affected, both by the bending and jarring forces at that point where the axle is held fast in the boss of the wheel, which is a mass acting as an anvil to break it over. The tendency to break at that point having been, of course, aggravated by the obsolete practice of the axle having a square shoulder of considerable size at the boss of the wheel, instead of the present usual plan of making the least possible difference in the diameter of the axle at that part for the purpose, with a long taper countersunk into the wheel.

It is, obviously, very desirable that every opportunity should be taken by those who are practically engaged in the working of railways to investigate the facts connected with the failures of axles in process of working, as detatched experiments, however carefully and impartially conducted, cannot faithfully represent or afford results corresponding to the effects of the various strains and forces to which axles are subjected whilst working on a railway.

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The CHAIRMAN observed, that at the first discussion on this subject he took the liberty of drawing the attention of the members to the extreme care that was necessary in coming to any conclusion as to a molecular change in the constitution of wrought iron. He thought that, although there were a number of facts and statements on record which appeared to render it extremely probable that some change did take place in iron, yet that it only amounted to a change in the particles in their relation to each other, which might in the end produce a brittleness or impart a crystalline character, these proofs were now multiplied in number, but he thought were not much increased in pointedness, if he excepted the experiment with the chain, which was the most striking and marked instance of which he had yet heard. Hence they must conceive that a change takes place in iron if subject to vibration; but an investigation into the precise cause of the change would require more time and care than could at present be devoted to it. He might remark, that since their last meeting he had turned his attention to ascertain, if possible, whether any real difference exists in the molecular arrangement of the material or structure of a piece of iron called crystalline, and a piece of iron called fibrous; and for this purpose he had examined them under a powerful microscope, and it would, probably, surprise the members to know that no real difference could be perceived, and that if he had not previously seen with the naked eye the specimens called fibrous and crystalline, he should not have been able to distinguish the one from the other in the microscope. The best specimen he could select of the kind called fibrous, exhibited to the naked eye a laminal arrangement of dark and light lines, but the light line composing the apparent fibre were, in point of fact, as crystalline as the other kind of iron, and, therefore, however fibrous it might appear, it was essentially a crystalline mass. Even in a piece of iron,

with large facets, which appeared extremely crystalline, when one of the crystals was examined, it gave much the same appearance under the microscope as a fibrous surface gives to the naked eye: in fact, it would appear to consist of bundles of fibres broken through at certain angles, just as slate was observed in the quarries to break in particular rhomboidal forms. Now, in the instance of slate, there was nothing fibrous or crystalline; but owing to the peculiar arrangement of the particles, it exhibited on a large scale something resembling the appearances to be observed in iron—like fibres being broken through in particular planes.

It appeared to him that the fracture taking place in an axle at particular points, might be illustrated by reference to a string being thrown into vibration. There were certain points of the string called nodes where no motion took place, because the action on the one side neutralises the action on the other, and the particles at the nodes have double duty to perform, being pulled in opposite directions at the same time; hence what might be called the nodes in the axle had great action upon them, and this might induce a crystalline appearance, although it might not cause much change in the structure of the iron. It appeared to him a matter of extreme difficulty to conceive a change going on in the structure of iron, because it would involve a change from one kind of crystalline structure to another, which was next to an impossibility. He could imagine that a number of particles under the influence of vibration might in time jostle each other into particular forms, and become fibrous; yet, when they examine most fibrous iron, they will find it already crystalline, which involved the necessity of the molecules leaving one form of crystal and taking another. It would be well for the members to communicate to the institution any well-authenticated facts of crystallization of iron, because nothing could have so important a bearing on the structure of railway axles as the means of tracing fractures to their real cause. Perhaps at their next meeting he might have the pleasure of exhibiting to the members certain microscopic results, but as yet he had not given the subject sufficient consideration to justify him in doing so.

Mr. Adams thought that the appearance called crystalline was caused by nothing more or less than a bundle of fibres, consisting of many small crystals being sheared off square, forming one face.

Mr. H. Smith inquired whether the Chairman thought there was any difference of strength produced. If they took the case of the common gag to the helve, or the prop that was placed under it, they found it became crystalline in the course of time, and very brittle, though quite fibrous at first. So also in the case of the chains on inclined planes, they broke very soon. He should like to know whether crystallized iron was not weaker than fibrous.

(*To be continued.*)

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## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 16TH, 1850.

Enoch Chambers, of Birmingham, Warwick, smith. *For improvements in the manufacture of wheels.* Patent dated November 10, 1849.

Wheels made according to this invention are each first made up into two halves, each half consisting of one half of the ring or felloe, one half the spokes, and one half of the nave, all of wrought iron, and the parts of a wheel are made in the following manner: For each half of the nave a block or plate of iron is forged in a cylindrical exterior frame, with a flanch or projection all round, and this flanch or projection is to be drawn out by forging, so as to form projecting pieces at those parts in the circumference where the spokes are to be welded on. In the wheel shown in the drawings which accompany the specification there are eight spokes, four on each half wheel, and in all cases this construction of wheel requires to have an even number of spokes, half being affixed or welded to one half of the nave, and the other half of the spokes being fixed to the other half of the nave, and the spokes being placed in such relative positions that those of the one half shall come into the spaces between those of the other half. The projection or flanch being thus drawn out or forged at intervals on each half of the nave of an intended wheel, so as to produce proper projections for the purpose of receiving the spokes; the spokes are to be welded on, each spoke having a portion of the ring or felloe of the wheel forged thereon, the alternate portions of the felloe or ring being on the two half naves respectively; so that when the two are brought together, and the inner surfaces of the two half naves are brought together, they will form the wheel. The two half naves are to be brought to a welding heat, and being placed one on the other, in the position above described, are to be welded together by a suitable hammer or press.

The patentee prefers to use a steam hammer for this purpose; and the parts of the felloe or ring of the wheel where they

some together are also to be welded, and the tyre is to be shrunk on, and the wheel completed. The centre of the nave of the wheel is to be cut or turned out, and made suitable to receive the axletree, as shown, and as is well understood.

Instead of welding the spokes and parts of the felloe to the half naves, before welding the half naves together, the spokes and parts of the felloe may be welded on afterwards, but the former method is preferred. In the preceding description special reference is had to railway wheels, but the same method of construction, it is stated, is equally applicable to wheels for common-road carriages and wagons.

*Claims.*—1. The manufacture of wheels by first making the nave in two parts (divided vertically) each having half the number of spokes, with a portion of the felloe attached to each spoke, and then welding together, the said two half naves, after which the tyre is shrunk on as usual.

2. The making of wrought iron naves with two flanches each to receive, and have welded thereto, one half of the spokes of which a wheel is to be composed.

Samuel Brown Oliver, of Deptford, Kent. *For certain improvements in dyeing materials.* (Communication from abroad.) Patent dated November 10, 1849.

This invention consists in the manufacture and use of certain mixtures to be employed in dyeing woollen fabrics, or fabrics containing a mixture of wool.

This materials employed in the manufacture of these mixtures consist of the following acids:—Sulphuric, nitric, arsenious boracic acetic, pyroligneous, oxalic, and tartaric acids, and of the following salts:—Chloride of sodium, or common salt, sal ammoniac, chloride of magnesium, chloride of potassum, sulphate of potash, sulphate of soda, sulphate of magnesia, oxalate of potash, acetate of potash, acetate of soda, nitrate of soda, nitrate of potash, sulphate of zinc and borax.

The mixtures which the patentee prefers —who, at the same time, does not confine himself to the exact proportions given, because, he states, variations in the proportions, or substitution of certain of the materials enumerated, may be made, so as to answer the purposes for which these mixtures are intended, are as follow:—

*First Mixture.*—100 parts of chloride of sodium; 300 parts of water; 10 parts of sulphuric acid; 3 parts of nitric acid; 1 part of arsenious acid.

*Second Mixture.*—100 parts of sulphate of soda or sulphate of potash; 6 parts of sulphuric acid; 2 parts of nitric acid.

The two mixtures above mentioned—namely, No. 1 and No. 2, are not to be employed in grain colours, or in any other colours in which solutions of tin are present, but the mixtures following, namely, Nos. 3, 4, 5, 6, and 7, may be employed for all colours, including grain colours, or other colours in which solutions of tin are present.

*Third Mixture.*—100 parts of sulphate of potash or sulphate of soda; 1 part of sulphuric acid; 3 parts of nitric acid; 6 parts of vinegar, or, in place of this, 2 parts of purified acetic acid.

*Fourth Mixture.*—100 parts of sulphate of soda or sulphate of potash; 6 parts of sulphuric acid; 3 parts of tartaric acid (powdered).

*Fifth Mixture.*—100 parts of nitrate of potash; 30, 40, 50, or 60 parts of sulphuric acid, according to the shade required; 1000 parts of sulphate of potash or soda.

*Sixth Mixture.*—100 parts of the fifth mixture; 3 parts of tartaric acid (powdered); 10 parts of acetate of potash.

*Seventh Mixture.*—100 parts of sulphate of potash or sulphate of soda; 4 parts of nitric acid: 4 parts of acetic acid; 10 parts of tartaric acid (powdered).

The materials of which the before mentioned mixtures consist, are to be left in contact several days.

The mixtures before mentioned, or other analogous compounds, are to be prepared in vessels not easily acted on by the substances of which the compounds are composed, the substances being allowed to act on each other until decomposition and admixture are thoroughly effected. The compounds are, when required to be afterwards dried by natural or artificial means, reduced to powder in a mill or mortar, all which is said to be well understood by practical chemists.

The before mentioned mixtures may be employed in dyeing woollen fabrics, or fabrics in which a mixture of wool is present, and are to be used in dyeing in the same manner as cream of tartar or argol is now used, the same weight of the respective mixtures being taken as would have been taken of cream of tartar or argol. The mixtures are to be used along with the aluminous or other mordants in the ordinary operations of dyeing. For the dyeing of dark colours, the mixtures may be employed without the addition of other mordants, but for ordinary purposes, they are employed as a substitute for cream of tartar or argol.

*Claim.*—The use of such acids and salts when combined in the manner and for the purposes above described, or when any of

them are made to substitute one another in such mixtures for like purposes.

Robert Parnall, London, clothier. *For a new instrument for facilitating the stitching or sewing of woven fabrics.* Patent dated November 13, 1849.

This instrument is similar to an ordinary screw-press. On the bed-plate is fixed a slab of wood, whereon several layers of the fabric to be pierced are laid. The top-plate is attached to the screw and carries the cutter, which is constructed something like a comb with the points of the teeth sharp pointed. Behind the cutter is a plate which is connected to the top plate by screws, but is free to slide up or down—the tops of the screws resting in transversal slots cut in the top plate for that purpose. The lower surface of this plate is made to project beyond the horizontal plane of the extremities of the teeth of the cutter by means of a spring placed between it and the top plate. The cutter is attached to the top plate by rods and thumbscrews, which take into transversal slots to allow of the lateral movement of the cutters, and, when two are employed, of regulating the distance between the rows of stitches. For collars or wristbands the cutters are arranged so that the holes may be punctured in a line, according to the desired curve or angle. The slab should be of such a nature as not to injure the points of the perforators when they enter.

The *modus operandi* is as follows:—The fabrics are arranged upon the wooden slab and the cutter brought down by turning the handle of the screw so as to cause the points to penetrate; after which the cutters are drawn up by reversing the motion of the screw, and the plate, which is pressed outward by the spring, will bear against the fabric, keeping it down, so as to prevent its rising with the cutters, and allow of their being freely withdrawn from it. The threads are then passed through the holes in the usual manner.

*Claim.*—The construction and use of an instrument having cutters or points therein for the purpose of perforating series of holes in woven fabrics to facilitate the processes of sewing and stitching.

Charles Cowper, Southampton-buildings, Chancery-lane, Middlesex. *For improvements in the manufacture of sugar.* Patent dated November 14, 1849.

The patentee states that this invention relates to removing impurities, and obtaining sugar from cane juice, beetroot juice, sugar solutions, and saccharine liquids; and that the object of using lime in the defecation of these liquids, according to the present system, is to effect the saturation of acids contained therein, and, consequently, facilitate the formation of scum, for which purpose the lime and juice are boiled together, whence result the following disadvantages:—

1. A great alteration of an azotized matter, the decomposition of which forms the greater portion of the ammonia that is disengaged, while the rest, combining with the lime, acquires a brown colour, and is dissolved in the juice.

2. A combination of a portion of lime with sugar, which becomes insoluble when exposed to a temperature of 212° Fahr., and is often removed with the scum, whereby a loss of sugar is occasioned.

3. An alteration of an albuminous matter which, combining with the lime, forms a stringy and viscous substance, that hinders the crystallization of the sugar.

4. An alteration of the sugar itself, which, under the influence of the matters the juice contains, and the heat to which it is subjected during the defecating and following operations becomes uncrystallizable, and acquires a brown colour which it is difficult to remove.

5. An alteration of the colouring matter, which, combining with the lime, pass from a green to a brown, gradually deepening in colour until it acquires the characteristic tint of molasses or raw sugar.

It has been repeatedly proposed to remedy these objections to the use of lime by filtering the syrup through animal charcoal, using a less quantity of lime, or acting on the precipitate with any of the re-agents—sulphuric acid, sulphate of alumina, carbonic acid, stearic acid, &c. But these operations failed from the fact that the formations had previously taken place, and the action of any of the re-agents on the precipitate, by reducing it to fluidity, set free the impurities contained therein, which were afterwards dissolved in the juice, thereby imparting to it viscosity and colour.

Now the patentee proposes to avail himself of the peculiar property of lime, at certain temperatures, to coagulate the organized tissues and organic and mineral impurities which the juices contain, and to use it in large quantities; but to escape the injurious results before alluded to by not raising the liquids to the boiling point. For this purpose he takes the juice, as it is obtained in the first instance from the cane or root, and heats it from 122° to 167° Fahr.; lime, previously slaked and sifted, is then mixed with it, and the temperature raised to from 185° to 194° Fahr., after which the impurties will either be removed by skimming or will subside to the bottom. The clear

liquid is decanted off. The sugar is obtained from the saccharate, which it forms by combining with the lime, by treating it with some of the known re-agents—by preference, carbonic acid—whereby the sugar is liberated, and a carbonate of lime formed. The carbonic acid is subsequently expelled by boiling the liquid. The liquid is filtered and concentrated, and placed in vessels to crystallize. The proportion of lime will depend upon the temperature of the weather, the quality of the juice and nature of the soil, and can only be determined by experience. Thus, for beetroot juice from 15 to 50lbs. of lime is used to 100 gallons of juice. The drainings of the loaves are defecated by mixing with them a proportionate quantity of lime and silica or alumina, which is found in plastic clays, to combine with the salts of potash or soda;—the proportions being 20 to 30 lbs. of lime, 2 to 4 lbs. of silica or alumina for every 100 gallons of juice. Care must be taken, as in the preceding case, never to raise the temperature of the liquid to the boiling point. The liquid is subsequently concentrated, and granulated sugar formed, which may be mixed with the drainings in the first instance, and converted into loaves.

It is proposed to generate carbonic acid by forcing a current of air, by means of a blowing cylinder, into a vessel filled with ignited coke and charcoal, and closed on all sides except where the air enters at bottom and escapes at top. The carbonic acid is led through a pipe, enveloped in a casing filled with cold water, and conducted to beneath the surface of a quantity of water, through which it escapes, and, after being thus washed and purified, is led into a coiled pipe placed in the bottom of the vessel, which contains the saccharine liquid. The carbonic acid escapes into the liquid through perforations in the tube, the aggregate area of which is equal to the area of the tube.

RICHARD FORD STURGES and JONATHAN HARLOW, both of Birmingham. *For improvements in bedsteads.* Patent dated November 10, 1849.

*Claims.*—1. The application of elastic supports to the angles of the frames of bedsteads [by coiling round each post a spring, upon the top of which the end of the rail rests. The spring is enclosed within a box or case. Instead of metallic springs, rings of vulcanized India-rubber may be used].

2. The application of gutta percha to the making of bedstead laths [by rolling gutta percha between cold steel rollers of the necessary peripheral form for giving the desired shape to the laths]; also a mode of making metal laths [by bending the central portion of each into the form of a ring, for the purpose of giving elasticity to it].

3. Two modes of making bedsteads [the first consists in bending two iron rods or tubes into parallelograms to form the sides. The ends of the tubes are bent at right angles to the sides, and are carried up a certain distance, when they are again bent. The two ends of each side are united by screw couplings to form the head rails. The second mode consists in passing two rods—bent so as to form three sides of a parallelogram—through the rails which are supported by tie rods which unite the head and foot posts].

JOHN CHESTERMAN, of the firm of Messrs. Cutts, Chesterman, and Beddington, of Sheffield, machinists. *For improvements in carpenter's braces and other tools, and instruments used for drilling and boring purposes.* Patent dated November 13, 1849.

Mr. Chesterman's specification comprehends several methods of communicating an equable and rapid rotary motion to hand and other drills, &c., of which we shall give a full description, with engravings, in a forthcoming Number.

CHARLES MATTHEW BARKER, Lower Kennington-lane, Surrey, engineer. *For improvements in sawing, or cutting wood and metals.* Patent dated November 10, 1849.

The patent describes and claims:

1. An improved construction of machine for compass or curved sawing. The log of wood is held at one end between the jaws of a dog, which is supported on a transverse slide. This slide is made to travel from side to side of the frame by means of a toothed rack and pinion, and to move towards the saws as the cut is made, so as to whip or pass the wood round the saws, and thereby cut it in a curved direction. The bevelling is effected by canting or tilting the rollers, between which the wood is held while sawing. To make tapering cuts, the saws are made to move towards or recede from each other; and one of them is made to work at right angles to the usual cut, for the purpose of scarfing. The number of saws in the saw-frame will, of course, depend upon the number of planks into which the log is to be sawn.

2. A circular saw, which is composed of segmental pieces arranged around a disc. Any desired number of these saws are fixed on a common axis, and pass over three screwed rods. Each of these rods has a right and left-handed screw cut on it, so that by turn-

ing them in one or other direction, the distance between the saws will be increased or diminished, and the thickness of the planks regulated accordingly. When this machine is applied to cut laths, every other tooth is inclined out, to make a rough cut in order that the surfaces of the lath may be irregular for the purpose of facilitating the adhesion of the plaster.

3. The adaptation of the machine just described to the sawing of crooked pieces of timber, such as trunks of trees, into planks. For this purpose, the frame which supports the log, and carries it to the saw, is fitted at the fore part with a lever, which turns on a pin, and has a clamping iron swivelled to it, at the other end, against which the fore end of the log bears. The after part of the frame carries a vertical screw-rod which passes through a female screw, the external periphery of which is toothed, and gears into a pinion. The upper part of the rod supports the dog, between the jaws of which the rear-end of the log is held. As the cut is made, the log is carried up to the saw, and the female screw is caused to revolve, whereby the rod will be gradually lowered, and the dog also; so that the portion of the log presented to the action of the saw will always rest upon the lower part of the frame.

4. The adaptation of the circular sawing machine to the cutting of ships' masts, spars, and booms. In this instance the piece of wood is supported in a frame, something like a lathe, on one side of the saw, and in a diagonal line to it, for the purpose of obtaining the requisite taper. When the cut is completed, the log is brought back to its first position, and a partial revolution communicated to it, in order that the succeeding portion of its side may be sawn, and so on, until all the cuts have been completed, and the log assumes the appearance of a tapering hexagon, or other regular polygon, After which a rapid rotary motion is given to the block, whereby the circular saw will act upon and remove the angles of the log, and convert it into a round figure.

5. The cutting of metals is effected by means of cutters arranged around a rotary disc, to which motion is communicated from any prime mover. When it is desired to plane the surface of the metal, the cutters are made to traverse from side to side by turning a screwed rod, which passes through a female screw cut in the interior of the disc.

Charles Edwards Amos, The Grove, Southwark, Surrey, engineer, and Moses Clark, St. Mary's Cray, Kent, engineer. *For improvements in the manufacture of paper, and in the apparatus and machinery used therein, part of which apparatus or machinery is applicable for regulating the pressure of fluids for various purposes.* Patent dated November 10, 1849.

The Patentees describe and claim—

1. The substitution for the couch roll of a perforated top roll which contains a suction box, worked in the usual manner, for the purpose of equalizing the tints on both sides of the paper when ultramarine or other colour is used.

2. A pulp-straining apparatus, which consists of the ordinary frame, having attached at top a band of vulcanized India-rubber. A belt of gutta percha or caoutchouc, containing plies of canvass, is attached to the band, and to two moveable pieces of wood, which have a rising and falling motion communicated to them from the main shaft by cranks and connecting rods. The knotter or sieve is placed above the belt, and the pulp fed into it as usual, while a pipe opening into the space between the sieve and belt conducts the strained pulp away to the vat. The rising and falling of the belt produce an alternate plenum and vacuum underneath the sieve and facilitates the passage of the pulp.

2. An arrangement of apparatus for regulating the pressure of steam in drying cylinders, in order that the pressure or heat may be gradually increased from the feeding-in to the delivery cylinder, so that this machine-dried paper may more closely approximate to soft-dried paper than has yet been practicable. This apparatus consists of a vessel into which the steam passes from the boiler, and whence it escapes to the cylinder. The upper part of the vessel is furnished with a piston, accurately turned to fit steam tight, which carries a rod loaded by means of a weight. The valve seat is placed in the lower part of the vessel, and is perforated with four holes for the escape of steam. The valve which slides over the seat, and closes or opens the steam passages accordingly, is connected to the under part of the piston. It follows from this arrangement that, when the steam pressure beneath the piston overcomes the resistance of the weight of the piston rod and forces it up, the passages will be wholly or partially closed, and the pressure in the cylinder regulated accordingly. One such apparatus is fitted to each cylinder, but with dissimilar weights in order that the pressure of steam may be varied. This apparatus may be, when modified, and applied to the regulation of the pressure or fluids generally.

4. Passing the web of paper, after it has been sized, through a trough of water previously to its passage to the drying cylinders, for the purpose of toughening it, for it

to allow of erasures being made and written over without the ink running.

5. Passing the web of paper, after drying, over a portion of a hollow roller, through which a stream of cold water is caused to flow, for the purpose of extracting the heat, and giving it what is termed "weather."

6. An improved construction of apparatus for dividing the web of paper into equal sized sheets, which is to work at a greater rate of speed than hitherto, in order that it may keep pace with the increased rate of production. In this case the web of paper passes over the gathering drum, to which a reciprocating motion is communicated from the main driving shaft. The paper is pressed against the drum by two rising and falling rollers, and the pendant end is carried by the drum between two cutters, which will then come into action and divide it; after which the end of the web is held while the rollers are lifted up, and the gathering drum revolves in the opposite direction, and takes hold of the web farther back, whereby, when the drum moves onward again, a fresh portion of the web will be brought between the cutters.

7. A glazing apparatus, which consists of a traversing table moving between three pairs of rollers driven from the main driving shaft. The sheets of paper are laid between plates of brass or boards, and subjected to pressure.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| May 9 | 2299 | Dent, Allcroft, and Co. ...... | Wood-street, Chespside ......... | The Osborne Cravat. |
| ,, | 2300 | Thomas Lant.................... | Birmingham ........................ | Fastening for trouser-straps. |
| 10 | 2301 | John Masters ................ | Leicester ............................ | Calesthenic or excercising belt. |
| ,, | 2302 | Pemberton and Son........... | Birmingham ....................... | Casement fastener. |

*(No English Patents Sealed this Week.)*

CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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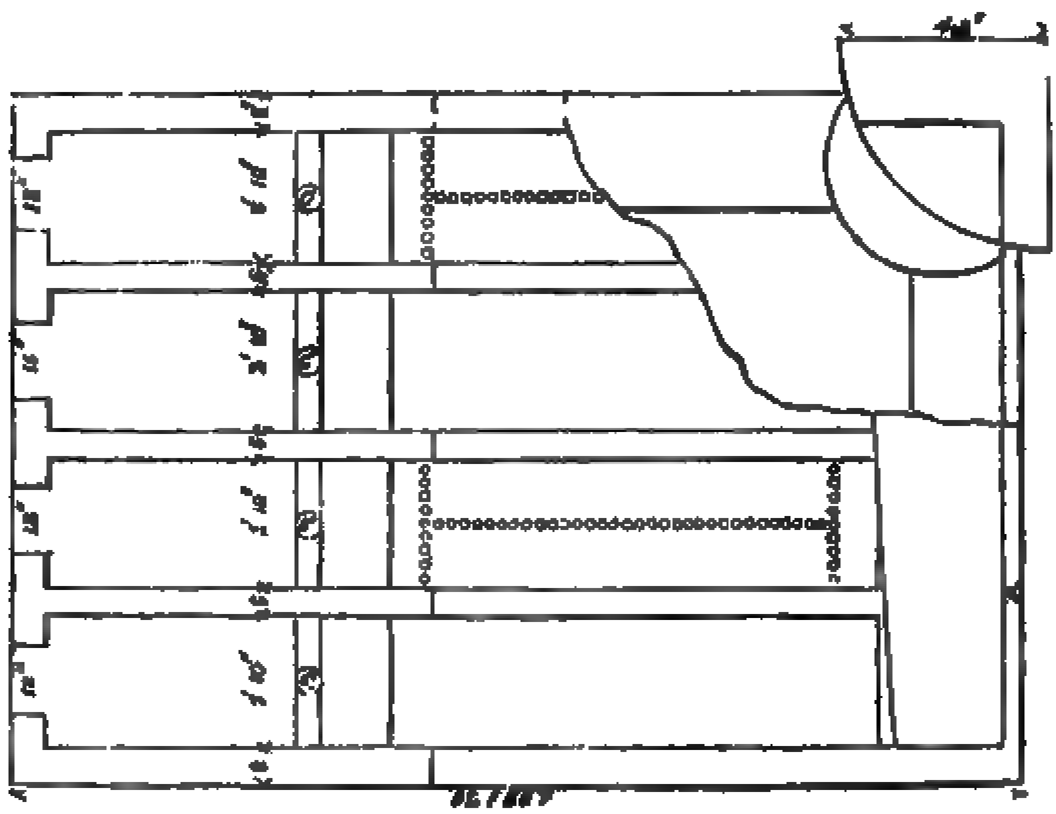
Edited by J. C. Robertson, 166, Fleet-street.


## THE UNITED STATES' MAIL STEAMERS "ATLANTIC" AND "PACIFIC."

Fig. 1.

Fig. 2.



THE UNITED STATES' MAIL STEAMERS "ATLANTIC" AND "PACIFIC."

We are enabled, through the kindness of correspondents at New York and Liverpool, to present our readers this week with engravings of the boilers of the *Atlantic* and *Pacific*, the first two of the new line of steam ships (called Collins's line), which are to run between Liverpool and New York, and with other interesting particulars respecting these vessels. The following are extracts from our correspondents' letters:

*New York, 29th April.*

* * I have just returned from a trial trip of the *Atlantic*, the first of our new line of ocean steamers (Collins's). She is, I suppose, the largest steam-ship ever yet built, being upwards of 3,000 tons burthen, which somewhat exceeds (I guess) your farfamed *Great Britain.* On coming up the Bay, with 20 lbs. of steam, cutting off on the expansion valve at one-half, and the throttle only two-thirds open, making 17 revolutions per minute, we ran from Fort Hamilton to the battery at New York in 28 minutes, second quarter of the ebb tide, which I take to have been 1¼ minutes against us, while the distance ran could not be less than 7¼ miles; so that the speed through the water was certainly not less *than seventeen miles per hour.*

The *Atlantic* was calculated by the late Mr. John Farron to start at 14—end with 18—average 16 revolutions per minute—to carry 18 lbs. of steam, cut off at half stroke, and burn 5,000 lbs. of coal per hour.

The cylinders (two) are of 95 inches diameter and 9 feet stroke, combined power per Boulton and Watt 800 horses power, but really 2,250 horses power; wheels 34 feet 2 inches over paddles, which are 12 feet × 2 feet.

*Calculation of Speed.*

Wheels 32′ 2″ effective diameter, allowing 26 per cent. for slip, and the whole distance from New York to Liverpool at 3,600 statute miles, 16 revolutions per minute will accomplish the distance in 11 days.

*Cause of Speed.*

544 feet of grate surface, and a very large amount of recipient heating surface in proportion to it, so as to need burning but 9 lbs. of coal (bituminous) per hour on each foot of grate—the most perfect combustion ever seen on any boat that I know of; no black smoke ever seen.

The Cunard steamer, *America*, has but 295 feet of grate, although the boilers occupy the same area (the height I do not know), and they are said to burn 800 tons per voyage; which is 23 lbs. per hour on each foot of grate, provided it were done in 11 days.

There is no material difference in the engines of the above-named steamers, except that the *Atlantic* has balanced valves; if, therefore, she beats the Cunarder's, as she most *undoubtedly* will, the merit must be in her *boilers* (four), small but powerful; the method of alternate firing is the cause of the combustion being so perfect.

I send you tracings, with which I have been favoured, of these boilers. Fig. 1 is, I take it, a longitudinal section, 2 a plan, 3 a cross section through the chimney and smoke box, and 4 a front view.

A sister vessel—the *Pacific*—is to be of the same dimensions, and on the same plan in every particular.

*Liverpool, May* 14, 1850.

I have been to see the *Atlantic*, which arrived here, for the first time, on Friday last. Time of steaming between New York and Liverpool, days hours. She is altogether a noble vessel—too large for any of the docks there, so that she is obliged to lay out in the river.

* * * There are four boilers, and they are fixed fore and aft. The fire doors are double, and have water circulating between the two plates of the doors. A carriage travels from side to side of the vessel by a screw; this carriage is a large coalscuttle, which goes under the coal bunkers, and is then moved by the screw opposite to each fire hole; the upper fire-places are fed from a stage.

There is a bell in the engine house, and before it are five holes in a box; and by the side of the paddle-wheel are five pulls like bell pulls. When one of these are pulled, it rings the bell in the engine house, and throws up a label opposite one of the five holes, and the one previously up is, by the same motion, thrown down, so that only one label is up at a time, and the one last pulled remains up. This does away with the hooting and shouting, and murdering the Queen's English, which you hear on board all our steamers.

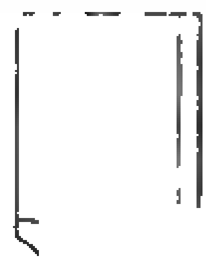
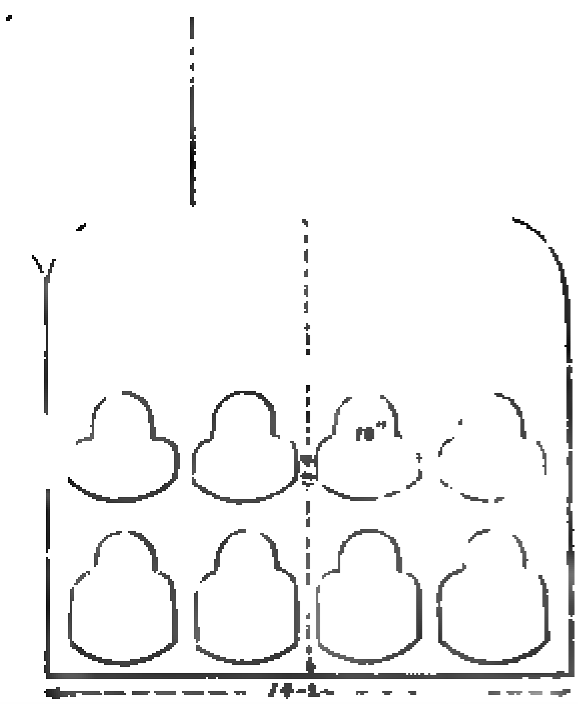


Fig. 3.

Fig. 4.



The cabins are heated by hot-water apparatus, and the vessel is ventilated by upright wrought-iron tubes all round the vessel, the open ends being protected from down currents or from wet getting down them.

The fittings are magnificent, and the accommodations most commodious. The machinery of the *Atlantic* was constructed by Stillman, Allen, and Co., of the Novelty Works, New York. She is amply supplied with Francis's metallic life-boats. She has no wooden boats. They are made of galvanized iron. Four hang on the quarters. She carries one of great capacity on the house as a "deck" or "spare boat." She has also on board a "life car," so as to be able to communicate with the shore under any circumstances. The *Atlantic*, as well as the other vessels, building for the same line, are so constructed as to be convertible into vessels of war in a few days should necessity require.

## THE EFFECTS OF MACHINERY ON THE WELFARE OF THE LABOURING CLASSES.

(Continued from page 387.)

The considerations to which the writer of the article in the *Cyclopædia* has not adverted, but which are essential to a full comprehension of the question—are the following: Taking the case, he has supposed, of a man with a capital of 10,000*l.*, one-half of which he "sinks" in machinery, in consequence of which he can obtain the same profits as before (viz., ten per cent. on his whole capital), even though his whole produce be now sold for 6,500*l.*, instead of for 11,000*l.*, as before: it is quite true that the sum of 4,500*l.* thus saved, annually, to the purchasing public, will be expended on labour in some other form: and so there appears to be no loss of the means of employment, but merely a change from one kind of employment to another. But, will the *whole produce* (in the branch of manufacture or trade we are considering), *be the same as before the introduction of the machinery, or greater, or less?* Suppose it is a cotton-factory in which this capital of 10,000*l.* is employed; and before the machinery was introduced. Supposing two hundred men were employed in it (giving as the rate of wages, 50*l.* per annum to each man, exclusive of the cost of raw material); and call the amount of cotton goods they produced, P.

After the introduction of the machinery, which costs 5,000*l.*, half the operatives are dismissed: the employer having now only half his capital disposable for paying wages and raw material. We have now three possible cases,—namely,

| | | | |
|---|---|---|---|
| 1st. | The machinery, | with the 100 men, | produce P, as before. |
| 2nd. | ditto. | ditto. | produce *more than* P. |
| 3rd. | ditto. | ditto. | produce *less than* P. |

The consequences of these three *cases*, are, as follows:—

*Case* 1. Supposing, as the writer has done, that the manufacturer only gets the same rate of profit as before, viz., ten per cent.; the purchasing public get the same quantity of cotton goods as before, for 4,500*l.* less money: which, therefore, they are now able to spend on any other sort of goods they choose, in the manufacture of which *some* of the one hundred operatives dismissed from the cotton factory may find employment. But, *how many?* Taking the same rate of profit and wages as before—this 4,500*l.* will afford a return to a capital of 4,090*l.*, which capital will support about eighty-two operatives, at their former rate of wages. There are thus eighteen of the hundred discarded hands, still to provide for. But there is the *profit* of ten per cent. on the capital of 4,090*l.*, viz., 409*l.*, which is still disposable. This would give employment to eight men at the same rate of wages: leaving still *ten* out of employment. And these will require a sum of five hundred pounds to keep them at the supposed rate of wages. But the machinery will need repairs which will give employment to *some* of the ten; leaving, finally, a number less than ten—as the "*victims*" of the machinery. As the cotton goods, however, are now cheaper than before, and as the operatives themselves will share in this advantage, the ninety and odd operatives who *are* employed may save enough from their wages by this cheapness in cotton goods (supposing them to buy *no more* of this sort of goods than before), to support the outstanding ten or less, in various wages. Or if *the employed* operatives do not thus choose to save anything by this cheapness of cotton-articles, *i. e.*, if they buy more of these goods than before, on account of their cheapness, at any rate a great number are benefited, at the expense of a few. If the repairs of the machines were such as to give employment to nine men, then there would only be one single individual out of the hundred left without employment, and whose wages of 50*l.* per annum would, in that case, express the loss by "wear and tear" of the machinery: an item which must always be sheer loss to all parties.

If the capitalist, who has introduced the machines, instead of getting only the same rate of profit as before, be able to obtain a higher rate (through the absence of competition), the only dif-

ference will be, that he gets some part of the 4,500*l.* which we have hitherto supposed the public to gain: the sum available for the employment of labour, remaining unaltered, only being in different hands to what it was before. If there be nothing to compel him to reduce his prices after the introduction of the machinery, or if he does not reduce them, with the hopes of an increased market, then he will pocket the whole 4,500*l.* per annum: and it is he who will have the command of labour, or of labourer's productions, to that amount, instead of the public who purchase his cotton goods. He may, if he likes, spend it on an increased number of household servants: and this would be simply equivalent to taking a certain number of the operatives out of the factory, and converting them into domestics. It is entirely at his option *how* he will spend this 4,500*l.* a year, whether in furniture, pictures, wines, or other articles, which are the produce of antecedent labour, or in what may be called, *direct and immediate* labour, such as that of servants. But, Mr. Ricardo, and others of his school, maintain that there is a very great difference between these two ways of expenditure, in their effects on the welfare of the labouring class. How much truth there is in this we shall inquire after we have gone through the examination of the other two cases.

*Case* 2. Here we suppose the introduction of machinery to have *increased* the gross produce. Now, if the manufacturer still is confined to the same rate of profit as before, and sells this increased produce for the same sum which he received before for the less produce, viz., for 6,500*l.*, then the whole gain in the increased produce goes to the public, the cotton purchasers. Not only are all cotton goods now *cheaper* than before the introduction of the machinery, and prices lowered, as in *Case* 1, but a greater quantity is sold than in *Case* 1; so that, as a greater quantity of goods is now sold for the same sum total as in that case, the prices of cotton goods are lowered still more than in the *Case* 1. Now, how does this affect the labour question? In what respect will this case differ from the former, in its effects on the demand and employment for the 100 dismissed operatives? We must remember that the same sum is spent on cotton goods by the public, as in the former case, viz., 6,500*l.* Either each individual purchaser may spend as much on these goods as before, getting however more for his money; or he may buy no more than before, thus saving a certain sum; but, on this latter supposition, there must be *more purchasers* than before, so as to make up the sum total of 6,500*l.* on either supposition; therefore, there is, evidently, no more to spend on *other branches* of manufacture or labour, than there was in *Case* 1. The public, in general, have gained just so much more cotton cloth, &c., and this is the sole difference between *Cases* 1 and 2. There is no more *saved* for the employment of labour or available for spending on other articles than in *Case* 1. On the supposition of the *number* of purchasers of cotton goods being increased (the old purchasers buying no more than they did in *Case* 1, and therefore each of them saving a certain sum more than in that case), some becoming purchasers who were not purchasers before; there will be a falling off in the demand and in the number of customers for some of the *other* branches of manufacture, or employment of labour: some of the purchasers of silk, woollen, hardware, or other branches, having transferred a certain portion of their incomes to the purchase of cotton goods instead. Their place and custom is now supplied by the original cotton purchasers who now spend their extra savings (their savings *over and above* their savings in *Case* 1), on these silk, woollen, and other goods. There is merely a transfer of customers and expenditure, no fresh demand or employment for labour.

There is one case conceivable in which such a new demand and employment might arise; and that is, where some one becomes a purchaser of cotton goods, who does not, at the same time, *purchase less of other things, or employ less labour in other branches*, than he did before. This can only arise from his having a larger income than before. Thus, if a farmer grows more corn, at the same expense as before, he will be able to spend this increased income on any branch of manufacture he pleases, *without thereby improving, or withdrawing his demand from other branches.* But if his income remains stationary, and if the increased cheapness of cotton

goods induces him to spend more on them than he did formerly, he can only do so by withdrawing exactly an equal expenditure from some other branch of trade or labour.

*Case* 3. Here we suppose the amount of cotton goods manufactured, after the introduction of the machinery, to be diminished. They may obviously still be cheaper than before the machinery was introduced, but they will not be so cheap as in *Case* 1. The manufacturer will get as much profit as before, provided he can sell the diminished produce for 6,500*l.* He sold the produce P, before the machinery was introduced, for 11,000*l.* Suppose the machinery, together with the hundred men, produces only three-fourths of P: then, if these three-fourths were sold at 8,250*l.*, they would still be as cheap as before: if sold therefore at 6,500*l.*, the public gains the difference between these two sums. As the same desire, however, will exist as before, for cotton goods, and the same sum be ready for their purchase, of course the original amount of produce P will again be made up by taking back some of the one hundred discarded operatives, and putting on more machinery. If the same proportions be still supposed to be kept up between the capital invested in machinery and that spent in wages, we shall have, in order to produce the remaining quarter of P, about thirty-three operatives, and about 1,666*l.* worth of machinery necessary; or, altogether an additional capital of 3,333*l.* required. But where is this fresh capital to come from? By supposition, the cotton manufacturer has already embarked all *his* capital. The only place it can (ultimately) come from, is the savings of the public (or the increased profit of the manufacturer, if there be no competition). But how much will these savings amount to? Supposing that, to begin with, only the three-fourths of the former produce is furnished, we have seen that the saving is 1,750*l.* in the year. But it is not worth while to make any further calculations on this supposition, viz., of three-fourths only of the former supply of cotton goods being produced, and these being cheaper than before, because such a supposition would never practically be realized.

A smaller quantity of goods being for sale, and the demand being as great as ever, the effect would be, that they would become dearer instead of cheaper. The same sum would be expended on them as before, most probably, *i. e.*, the 11,000*l.* The *increased* profits of the manufacturers therefore would be 4,500*l.* (supposing no competition), and this he would immediately invest as fresh capital in producing more of his goods, and at least bringing up the amount of produce to its original state. For the first year, the one hundred dismissed men would be out of work. [We, all along, go on the supposition, that *everything else* except this one manufacturer, or rather single factory, remains "in *statu quo*,"—no capital lent to the manufacturer, and no opening for his former workmen in other branches]. At the beginning of the second year, he would have this 4,500*l.* additional capital; if doubled equally between fresh machinery and hands, this would enable him to take back so many of the operatives as 2,250*l.* would support at their former wages, viz., forty-five. And, as the capital of 10,000*l.* thus employed only produced three-fourths of P, this additional capital of 4,500*l.* employed in precisely the same manner, will produce twenty-seven eightieths of P, or seven-eightieths more than the quarter of P required to make up the original produce. So that, on the supposition of an introduction of machinery of such a nature, as to reduce the produce to three-fourths of its original amount, we see that the loss might be more than made up in one year, by the public paying the same sum as before for this three-fourths of the goods, for that year. But even this is not the way in which matters would proceed in actual business.

In order to make up the original quantity of cotton articles, the manufacturer would *borrow* the necessary capital. But what was this capital doing before? Evidently lying idle, either in banks or elsewhere. But how is it that it was so laying idle? The usual technical answer is, "Because there was no *profitable investment* for it." But the possessors of this idle capital, certainly have wants and desires still ungratified, and which this money or capital would procure for them if they chose: how is it then that they have not thus employed it? In other words, how is it that they have not either employed this capital in

some branch or other of manufacture themselves, or lent it to others for that purpose; or, lastly, expended it on the *direct* maintenance of labour in the shape of menial servants, &c.? We have said above, and all writers on these subjects concur unanimously in asserting, that all capital is expended on something or other, on direct labour or the results of labour: how are these two things, then, reconcilable? Is the capital thus lying idle, because there are no *unemployed* labourers? It were well for the labourers if such an event ever happened! But the very idea is out of the question. There is unemployed labour on the one hand, and unemployed capital on the other: and yet it is a fundamental principle in political economy, that all capital is employed in setting labour to work! Is not this something very like a contradiction! The answer is, simply, that this capital is lying idle *only for a time*, and that generally a very short time. Sooner or later it *is* employing labour in some way or other.

But, it may be asked, will not the capital thus borrowed by our cotton manufacturer, be just so much subtracted from some other manufacture, or mode of employing labour? We reply, that the very fact of his being able to borrow it (unless he did so, at a higher rate of interest, than the ordinary rate at the time), proves that other manufacturers did not want it; could not employ it profitably in *their* business. Still, though not actually withdrawn from any existing branch of manufacture or labour, this capital is now prevented from being employed in some *new* branch, or in some new employment of labour.

The capital thus borrowed will be gradually replaced out of the annual savings caused by the introduction of the machinery, and the greater these savings (the greater the productive power of the machinery), the sooner will the capital be replaced; and the sooner therefore will there be the same *means* of employing fresh labour as before it was borrowed.

Now, from a review of these three *Cases*, it will be seen, that it is only this last case which is injurious to the interests of the labouring class for any length of time. When the machinery, with the help of the hands still employed in the factory produces as much, or more, than the whole number of hands did before: then the displaced operatives will only be kept out of work for the period necessary to transfer their services to some other department of labour. But when the machinery, with the aid of the hands kept on, does not produce so much as the whole number of hands produced originally, then there will be two contrary effects on their interests; for, as we have seen, capital will be borrowed by their employer by aid of which he will set up new machinery and also recall some of the hands he had dismissed at first. So far benefiting the labouring class; but, on the other hand, the hands who still are left out of work, will remain so far a much longer period than in the *Cases* 1 and 2. For they will have to wait until the annual savings caused by the machinery amount to sufficient to replace the borrowed capital.

In all the three *Cases*, and throughout the whole of what has hitherto been said, we have supposed that every thing remains as it was before, except in this single branch of manufacture we have been considering. We suppose all other branches to remain "in *statu quo*," and that the *income* of the purchasing public remains exactly the same,—that they have just the same means of buying cotton goods as before, and neither more nor less money to spend on them. But the sum, which the public spend on cotton goods may be increased in either of the following ways:—1st. They may have a larger income than before; and, consequently, be able to spend more on cotton goods *without thereby lessening the demand for any other description of goods:* or, 2nd. They may be induced by the greater cheapness of cotton goods to spend *a greater proportion* of their income on these goods; but if their income remains the same, this can only be done by their buying *less* of some other sort of goods.

In either case the cotton operatives get the benefit; but in the latter case, they do so at the expense of the operatives in some other branch of employment. "I cannot," says Mr. John Stuart Mill (Pol. Econ., vol. i., p. 113), "assent to the argument relied on by most of those who contend that machinery can never be injurious to the labouring class, viz., that by cheapening production it creates such an increased demand for

the commodity as enables, ere long, a greater number of persons than ever to find employment in producing it." The fact, though too broadly stated, is, no doubt, often true. The copyists who were thrown out of employment by the invention of printing, were doubtless, soon outnumbered by the compositors and pressmen who took their place; and the number of labouring persons now occupied in the cotton manufacture is many times greater than were so occupied previously to the invention of Hargreaves and Arkwright, which shows, that besides the enormous fixed capital now embarked in the manufacture, it also employs a far larger circulating capital than at any former time. But if this capital was drawn from other employments; if the funds which took the place of the capital sunk in costly machinery, were supplied, not by an additional saving consequent on the improvements, but by drafts on the general capital of the community; what better are the labouring classes for the mere transfer? In what manner is the loss they sustained by the conversion of circulating into fixed capital, made up to them by a mere shifting of part of the remainder of the circulating capital from its old employments to a new one?"

## MESSRS. KEELY AND WILKINSON'S PATENT IMPROVEMENTS IN LOOPED OR ELASTIC FABRICS, AND IN FRAMEWORK-KNITTING MACHINERY.

(Concluded from p. 384.)

*Secondly*. Our invention consists of a new method of finishing by the loom the ends of fingers of gloves, which is intended to be substituted for the ordinary "taking off," a term well understood in the hosiery trade. The manner in which we proceed with this part of our invention is as follows:—The fingers being woven till within about one-half of an inch from the end, the workman makes an eyelet hole in the centre of the finger, and then having completed the whole length finishing with a slack course, he makes a cut from the eyelet hole to the end of the finger. The half of the finger which is on the right side of the cut is placed in a small wooden holder, generally known in the trade as a "toe peg," and taken off from the needles, after which it is turned over upon the other half of the finger, and the loops slipped upon the needles, so that the loops of the one-half correspond with those of the other (being upon the same needles). The innermost loops are now drawn over the outermost loops, and then successively turned off by drawing the one through the other in a similar manner to that in which the junction of the heel of a stocking is formed. In seaming the fingers, there is laid off a small seam, so that when sewed, it shall have the form represented in fig. 18.

The preceding method of finishing fingers of gloves is equally applicable to all kinds of knitted gloves made from the loom.

*Thirdly*. Our invention consists of another arrangement of framework knitting machinery, whereby two or more webs with separate selvages may be worked in one frame at one and the same time, and whereby also several frames may be worked simultaneously by one prime mover. Fig. $18^a$ is a front elevation, and fig. 19 an end elevation partly in section, explanatory of this arrangement. AA is the framework of one machine; B is the needle bar upon which the needles *a a* are fixed in the same manner as in warp machines and stocking frames; $C^1$ $C^2$ are two sleys which are affixed to the needle bar by means of brackets $C^3C^3$. $D^1D^2$ are two rails which are set as nearly in perfect parallelism to each other as may be; these rails are planed and straightened upon their sides and upper edges, and serve for the carriage E to travel upon, as afterwards explained. F is an endless screw which is turned by the crank handle G, and gives motion to a worm wheel H. On the same spindle with the worm wheel there is fixed a pinion I, which gears into a wheel K (similar to that well known as being used in Baker's patent mangle), affixed to the shaft $L^2$. By this arrangement the rotary motion of the shaft of the worm wheel and pinion causes an alternating rotary motion of the shaft $L^2$, and of the band wheel M, which is keyed upon it. The carriage E is attached to the band wheel M by two bands or chains which are passed over the pulleys N N, so that the alternating motion given to the band wheel is communicated to the carriage, and causes it to traverse upon the rails $D^1D^2$, from one end of the machine towards the other, or for any lesser distance corresponding with the particular width of web desired to be woven. *b b* are the sinkers which are placed in the partitions of the sleys $C^1C^2$. A separate view of one of these sinkers is given in fig. 20. Near to the upper end of the sinkers, and upon the back edge thereof, there is a bevelled projection *c*, by which they rest (when not acted on by the carriage) upon a bar forming the back of the sley $C^1$. The pressers *c c*, which are separately shown in fig. 21, are fixed in a comb formed upon the upper edge of the

needle bar, and held in their places by a rod $f$, which passes from end to end of the needle bar, and through a hole $d$ formed near to the centre of the pressers; and they are at perfect liberty to turn upon the rod when acted upon, as afterwards explained. For every needle there is a separate presser. The carriage E is composed of two grooved bars, $d^1 d^2$, a plan of one of which is given separately in fig. 22. The upper and lower ends, $x\ x$, of the sinkers successively take into these grooves as the carriage makes its transit over them, whereby the sinkers are made to perform several distinct operations in the formation of the loops of the fabric; while at the same time the pressers are successively brought down upon the needles by the action of part of the carriage represented in fig. 23, and which is connected by a pin or axle passed through the hole $e$, to the back of the carriage, and occupies such a position that the back ends of the pressers fall into the peculiar shaped slot or channel $f^2$. The result of the passage of the carriage E along the bars, is that the threads passing through the guides L, from the bobbin P, are laid upon the needles; the sinkers are lifted up and placed over the threads, and then falling down, take down along with them the threads a sufficient distance to form the loops; the threads are then passed under the beards or barbs of the needles by a forward motion of the sinkers, resulting from the peculiar form of the grooves in the carriage; the pressers are next brought down by one or other of the wheels $g\ g$, fixed in the slot or channel $f^2$; and the loops of the fabric previously formed are by the forward motion of the sinkers made to pass over the barbs of the needles till they are finally cast off, and the loops of the next row completed.

The changes necessary to be effected previous to the return of the carriage, to act upon the sinkers, are produced by the cords $h^1\ h^1$, $h^2\ h^2$, the former of which ($h^1\ h^1$) act upon a lever $i^1$ centred in the upper bar of the carriage, and the latter ($h^2\ h^2$) upon a similar lever $i^2$ centred in the lower bar. These levers raise and lower small inclined planes jointed to and forming part of the floor of the grooves in the upper and lower bars of the carriage. At the end of each stroke or travel of the carriage E, the slot or channel $f^2$ in the back part of the carriage is put in such a position that it will produce the dipping of the pressers at the proper interval, being acted upon by a pin or stud affixed to the lower rail $D^2$, against which the tail $k$ is made to strike, which turns up the channel into its proper position (or it may be acted upon by a cord attached to the band wheel). In some cases we propose, instead of using a separate presser to each needle, to employ a disc or wheel presser, in which case the disc would be attached by an arm to the carriage E, and be placed so that in rolling over the barbs of the needles it would produce the operation of pressing. Instead, also, of having only one carriage mounted upon the frame, as represented in the engravings, we mean to mount two or more such carriages upon the same bars, and so to connect them together that each carriage may produce a regularly selvaged web, as in the case of the loom or frame represented in figs. 1 and 2, and before described. We propose, moreover, to work a number of frames all on the same plan as the preceding, by mounting the several frames behind one another in an ascending order, after the manner of steps or tiers, connecting each frame to the endless screw F, which will serve as the common prime mover to the whole.

*Fourthly*. Our invention consists in adapting the common warp frame to the production of that class of looped or elastic fabrics called braids, whereby we are enabled to produce by one frame and one set of movements, and at one and the same time, a great number of such braids (now ordinarily manufactured one at a time), and either all of one pattern or of as many different patterns as there are braids. We employ for this purpose a frame of the ordinary and well-known construction, with two, three, or four guide bars, each bar being filled with guides. Hitherto it has been the practice in threading the guides to put only one thread into a guide; but for the purposes of this part of our invention, we put from two to five threads into each guide, varying the number according to the kind of braid which is to be formed. The guide bars are actuated in the usual manner, by means of wheels and cams, so as to produce the various shifts necessary to produce the loops. The "cut" or form of the wheels for effecting these movements in the guide bars will vary according to the kind of braid to be produced, as exemplified in figs. $1^b$, $2^b$, $3^b$, and $4^b$. The changes effected by the wheels, fig. $1^b$ and fig. $2^b$, are calculated to produce a braid or web upon two needles; with the addition of the wheel, fig. $3^b$, a web is produced on four needles; and with the further addition of fig. $4^b$, a web or braid upon six needles. When the six needles are employed, the breadth of the braid admits of its being striped; but in all cases, whatever may be the number of needles employed or taken up in the formation of a braid, patterns can be given or put into them in the manner afterwards explained. The braid can also be made of various forms, as flat, round,

or angular, which forms depend upon the number of threads employed for each needle. Two threads to a needle produce a flat braid, four threads to a needle produce a square braid, six threads an angular braid, twelve threads a round braid; and any one or all of these different forms of braids may be produced, at one and the same time, by the same cut of wheels and movements of the guide bars. The patterns, however, depend upon the manner of warping the thread upon the beam; as exemplified in the following description of the method of warping the thread for a six-threaded pattern. The whole of the threads are here supposed to be of different colours, but exactly the same process is followed for a six-threaded braid when all the threads are of the same colour. The threads are taken from the bobbins, and passed singly through the holes of a "brass," and wound upon a warping mill, from which they are again taken in pairs, every two threads being passed through the brass, and warped on to the beam in that combined state as two sets of three threads each. From the description which we have given, any competent working man acquainted with cutting the wheels and putting the patterns into a warp loom, will be able to put on an endless variety of patterns.

By the same method of working the warp loom, we are enabled to plate or cover thread of an inferior with thread of a better sort. Whatever may be the number of webs or braids, and however many or few may be the needles employed for each braid (within the limits before mentioned) every needle in the loom is occupied, except where three needles are employed in plating or covering, in which case the centre needle is left empty, the guide bars being threaded 2 and 1, which arrangement has the effect of concealing the centre thread, which may be of a coarser material than the others, and it may also be of much greater substance, as it never enters into the barbs of the needles.

When we make round braids over three needles, we find it convenient to employ three warp beams for the yarn.

Fig. $5^b$ is an elevation of a reeling machine which is attached to the end of the frame of the warp machine by the axles *a a*, upon which it revolves. It occupies a position immediately under and parallel to the warp beam and needles. The braid, as woven, is wound upon the reel by turning it either by hand, or it may be actuated by a motion from the machine. When the proper quantities are reeled on the machine, the screws *b b* are slackened, which allows the stretchers *c c* to come closer together, when the hanks of braid can be easily removed and tied up for sale.

*Fifthly*. Our invention consists in adapting a guide, such as is represented in figs. 5 and 6, and before described, to each spindle of the common braiding machine, and also mounting four bobbins on these spindles, so that there may be four threads laid in by the guide, instead of having a single thread laid in each time, as is now the practice. By this arrangement, the braid or elastic web will be covered more speedily, and a less quantity of silk will be required for that purpose. The employment of these extra threads affords also greater facilities for producing various patterns. When the elastic web is composed of strands of caoutchouc, we cause the web, as formed, to pass over a heated drum, by which the elasticating and finishing process is performed. The drum is put in motion from the braiding machine.

*Sixthly*. Our invention consists of an arrangement of machinery for producing looped fabrics, in which the needles are arranged round a common centre (as in the well-known circular weaving machines), but are worked in sections independently of one another, each section being calculated to produce a separate web, with a selvage on each side, and the number of sections being variable at pleasure, according to the width desired to be given to the webs and to the diameter of the circle from which they are struck, whereas the circular looms, before referred to, are capable of producing but one continuous cylindrical web, without any selvage, which web must be cut through when used in any other than its original cylindrical shape.

Fig. 24 is a plan, and fig. 25 a vertical section of a knitting frame or loom of this description, divided into three sections or divisions, which, from the distinctive peculiarity of its action, we call "The Turnagain Loom." A is a central vertical shaft, to which is attached a circular needle bar B, both of which are fixed and stationary. C C are the needles, which radiate outwards from the bar, and are divided into three sections, with short vacant spaces between the sections. To each section there is attached a separate set of the five moving or working parts next to be described; that is to say, firstly, guides D D, which lay in the thread to the needles from the bobbins K, K, K, which guides are similar to those used in the machine before described, and represented in figs. 5 and 6, and are attached to an expandible ring F, shown separately in fig. 26; secondly, presser wheels E E, which are attached to a ring L; thirdly, feed wheels G G, which are attached to a ring M; fourthly, driving wheels H H, which are attached to a ring N; and fifthly, driving pins I I, of which there is one within each

needle gate. All the three sets of these several moving parts are put simultaneously in motion in the direction of the arrows by the turning of the crank handle T; and each

Fig. 18a.

F

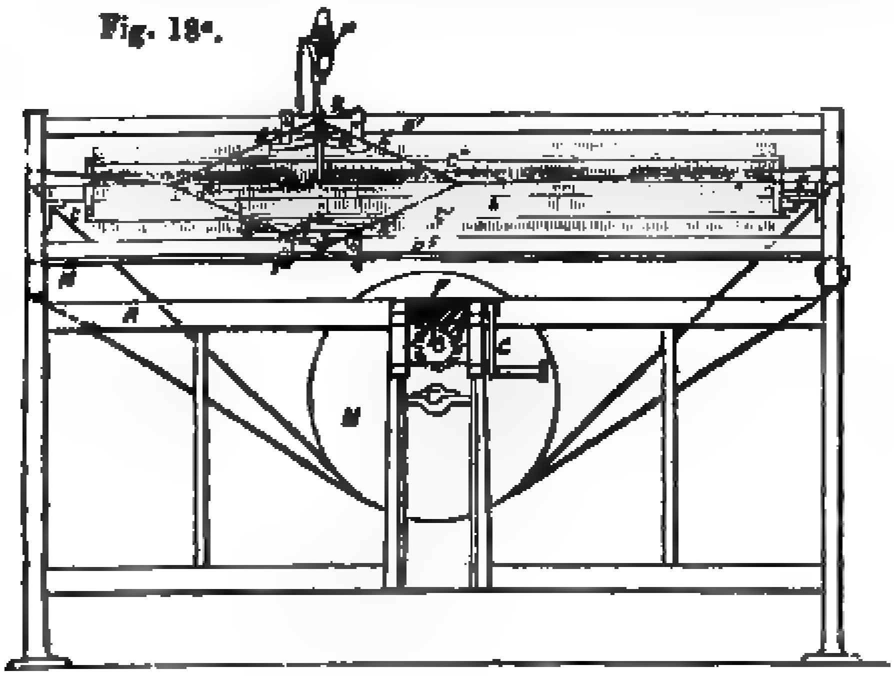


Fig. 21.

Fig. 19.

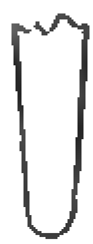


Fig. 23.

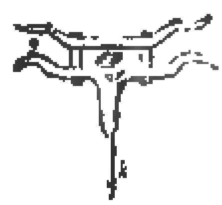


Fig. 20.

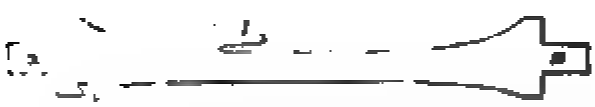


Fig. 22.

Fig. 25.

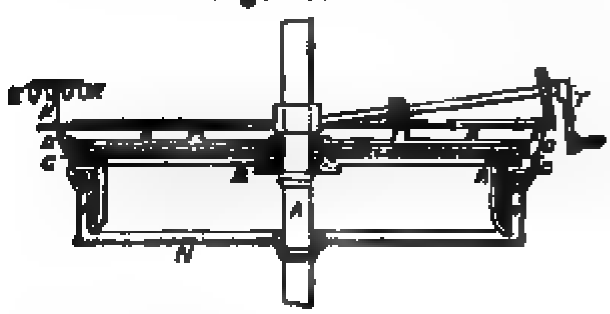


Fig. 28.

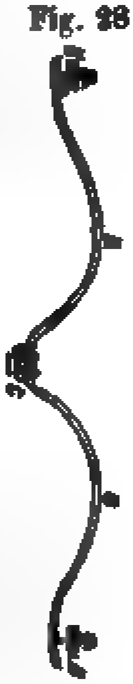


Fig. 27.

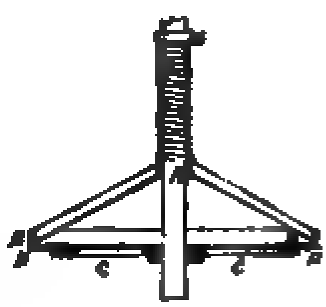


Fig. 24.

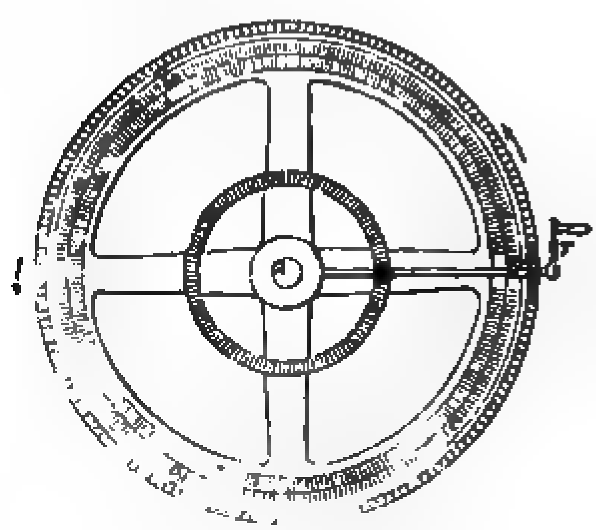
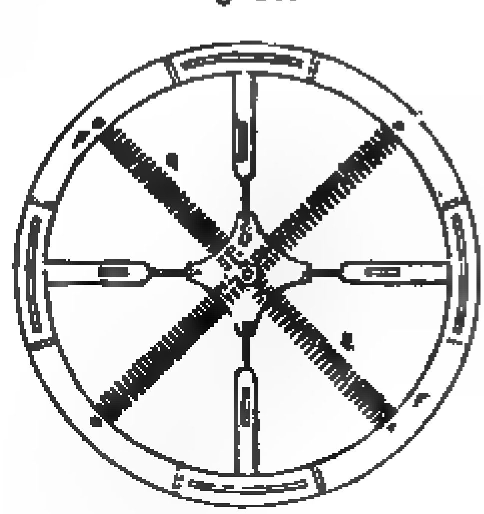


Fig. 26.



set, after traversing in one direction the section of needles to which they belong (having produced in that traverse one row of loops), are made to turn round and retraverse them

in the opposite direction (producing thereby a second row of loops), and so on continuously till the webs are completed. It is this "turnagain" movement, or working to-and-fro over the needles in sections, which constitutes, together with the dividing the needles into sections, the chief feature of novelty in this machine; and the means whereby this movement is accomplished fall next to be described. As soon as the guides D D have passed over all the needles of the section to which they belong, and come over the open space between that and the next following section, there is a cam O, which causes the ring F to expand, and so carry the guides out of the way of the feed wheel E, in order that that wheel may complete its traverse; and so also, when the feed wheel has passed over all the needles, the ring M, to which it is attached, is lifted up by a cam *m m*, which allows the axle of the presser wheel to pass freely underneath. And when the driving wheel H has pushed out all the driving pins I I, then the entire series of operations is reversed; the cam O, upon a slight impulse being given to it, allows the ring F to contract by the action of the springs Q Q; the guides then pass on to the needles, and the feed wheels, pressing wheels, and driving wheels come successively into action as before. In the engravings there are four bobbins and threads shown for each guide, and these threads are thrown in in column, so that, by using different colours and qualities of thread, plated and mixed patterns of fabrics may be produced. In some cases, we employ auxilliary guides for the purpose of producing stripes in cloths; and in making this kind of fabric, both guides are jointed to the ring F, so that either of the guides may be turned out of work at pleasure (an arrangement which is also applicable to the striping of welts in stockings.)

Instead of employing a wheel for pressing down the barbs of the needles, as has just been described, we sometimes employ a presser ring such as is represented, partly in section, fig. 27, by which the whole of the needles are pressed at once by one action. A is the central spindle; B B the presser ring or bar; C the needle bar; D D the needles; E a spring, by which the presser ring or bar is lifted up after having performed its work. This ring is actuated by the foot of the workman, by means of a treadle, or, when the loom is worked by power, by means of a cam.

In the loom figured in the engravings, the needles are divided into three sections; but it will be obvious that they may be divided into any number of sections which may suit the convenience of the manufacturer.

The number of sections may also be either set off permanently at starting, or the number of these sections may be varied from time to time by covering over or stopping out portions of the needle by means of sliding plates. By the ordinary circular loom, a web of one dimension only can be made, and for every separate dimension there must be a separate loom or machine. Nor can a circular loom which has been originally made to produce one dimension of web, be afterwards changed to produce another without an entire breaking up and reconstruction of the machine. But, by means of our "turn-again loom," webs of all widths, and with perfect selvages, may be manufactured at pleasure.

Again; in working with the common circular loom, the courses of loops form, of necessity, a series of spirals, which give to the fabric a twist, which renders it difficult to make a good-fitting article of apparel out of it; whereas, by our mode of working the needles in segmental sections, and reversing the courses at the end of each section, the courses become all as perfectly parallel as if produced by the ordinary rectangular weaving, and thus obviate the difficulty referred to. We have described the needles as being arranged in a circle round a common centre, and worked in segmental sections, which is the arrangement we prefer; but the circle may obviously be resolved into a polygon of any convenient number of straight sides; and our "turn-again" movement is just as applicable to the working of the needles in straight as in curved sections. We do not restrict ourselves, therefore, to any particular form of section, but claim a right to dispose or arrange the needles in any form to which our "turn-again" movement is applicable.

When it is desirable that the web formed upon this modification of the circular loom should be faced, on account of the quality of the thread employed, then we employ two expanding rings, composed like that before figured and described, of several segmental pieces sliding laterally over each other. One ring is placed underneath the needles behind the driving pins, and acted upon by a cam at the end of the formation of each course of loops. The ring expanding at that instant, acts as a driving bar, and gives face to the web, but is prevented from pushing the web too far out by the second ring, which contracts and pushes the loops of the formed web sufficiently far back to allow of the formation of the next following course.

By another improvement in the circular loom, before referred to, several webs may be worked by that loom at a time, and these webs be of any desired width, but without selvages. The circle of needles

is divided, as in our "turn-again" looms, into any required number of sections, and short vacant spaces left in the needle bar between the sections. The extent of these sections may be also diminished or enlarged from time to time by the temporary superposition of plates, as before explained. But the working parts by which the looping of the threads is effected, instead of turning back at the end of each section, and retraversing the same, proceed continuously round the entire circle (thus leaving the webs of necessity without any selvage); and when the webs are finished, they are separated by cutting through at the divisional spaces. To make up for the absence of selvages in this case, we attach a fixed bar of bobbins, or a warp beam, to the loom, for the purpose of introducing a warp thread through the terminal looms of each web, which will effectually prevent them from running. This thread does not enter into the beards of the needles, but is simply embraced by the loops which are formed round it. Similar warp threads may be introduced in the same way into the body of each web, for the purpose of strengthening the same.

The preceding mode of tying and strengthening looped and elastic fabrics may be applied to the said fabrics, by whatever description of loom the same is manufactured; and also to striping, ribbing, or otherwise figuring such fabrics.

By the use of three guides, in either the "turn-again loom," or the divisional circular loom, in combination with the expanding ring, any portion of the web—as, for instance, the heels of stockings—may be thickened, and varied in thickness. Any one or two of the guides can be thrown out or into action at the pleasure of the workman, and the thickness thus increased or diminished, always within the limits of the three guides.

*Eighthly.* Our invention consists in obviating the necessity which the workman is now under in the case of knitting heavy or stiff yarns, of having frequently to press down the jacks by hand to cause the sinkers to form the proper length of loop. We employ for this purpose an upper roller slur-cock, which travels along the front cross bar, and is put in motion by being connected to the cord of the under slur cock. That part of the slur cock which comes in contact with the jacks, is a circular disc or roller, and therefore passes readily and freely over the jacks by a rolling, and not a sliding motion, and secures their being pressed down till they come in contact with the falling bar, by which they are stopped, and the production of a level web thus secured, which with the common slur cock alone is often difficult to attain. This rolling slur cock is attached to a frame, and is made by screws or "stars" adjustable with the greatest nicety to any thickness of weft or web.

*Ninthly.* Our invention consists in the addition to the common stocking frame of a manspring of the peculiar form represented in fig. 28, for the purpose of diminishing the labour required to work the same. The two ends of this spring bear upon the fore arms, and the opposing point of resistance is upon the lower gibbet. AA are cross sections of the fore arms, B B the spring, and C the gibbet.

*Tenthly.* Our invention consists in a new construction of needle and point bar suitable for the manufacture of looped or elastic fabrics. We cast the needles and point in one lead, so that the needle bar contains points as well as needles. For example; we cast in one lead either two needles and one point, or two points and one needle, or one point and one needle. This combination of points and needles in the same bar enables the frame-worker to make ribs at once without having first to make certain loops, and then to let these loops down, whence this class of articles are now commonly termed "let-down ribs."

*Eleventhly.* Our invention consists of an improvement in the machine bar employed in framework knitting machines. At present the machine bar carries ticklers only; but we propose to make it carry also the guides and points, the tickler, the guide and point of each bar being cast separately, and moveable on their respective axes.

*Twelfthly.* Our invention consists of an improvement in the mode of forming tucks in looped fabrics. Instead of working the sliding plates upon the presser bar by hand, as is now the practice, we work them by means of wheels with cut patterns upon them, which actuate the plates at the proper intervals to produce the loops required.

CLAIMS.—1. The manufacture of looped or elastic fabrics and of articles made therefrom of three or more strands or threads disposed columnwise or parallel to each other, each or some of which are of a different material or materials from the others, or all the threads of one material, and the whole so knit or looped together, that the threads of one material (say that which is cheapest or strongest) are thrown into the interior of the fabric, and those of the other material or materials (say those which are the most costly and showy) form the outer surfaces of the fabric or article.

2. The manufacture of looped or elastic fabrics with three or more threads disposed

columnwise or parallel to one another, as aforesaid, irrespective of any difference in the materials of which these threads are composed.

3. The improved framework knitting machine first before described, by which the many threaded fabrics and articles aforesaid are produced, and a number of webs or articles are woven in the frame at one and the same time, each having separate selvages, and whereby also fabrics composed of a single thread, or of two threads, may be woven; that is to say, in so far as regards the compound guides L L and *l l*, for laying the thread into the needles; the carriage K and rail I, on which the guides travel, with their appurtenances; the peculiar shaped sinkers (figs. 3 and 4), the bobbin box N, the fixed bar of bobbins and carriages (fig. 8), the unwinding levers $P^1P^2$, and parts in immediate and necessary connection therewith, and the fixed combs T T.

4. The parts lastly before enumerated as constituting the peculiar features of the improved framework knitting machine first before described, each by itself individually and separately, whether as applied in that machine, or as the same may be applicable to any other machine for producing looped or elastic fabrics.

5. The improved jack with points and guides for figuring looped fabrics, before described, and also the adaptation thereof to the raising of a pile upon looped fabrics, as before described; whether the said jack or adaptation thereof be employed in combination with the improved framework knitting machine, aforesaid, or with any other machine for producing looped or elastic fabrics.

6. The mechanism for figuring looped or elastic fabrics represented in figs. 10, 11, and 12, before described; that is to say, the double frame of wirework and the warp roller for adding independent threads.

7. The method of finishing the ends of the fingers of gloves, as before described.

8. The arrangement of framework knitting machinery for weaving two or more webs with separate selvages at one and the same time, represented in figs. $18^a$ and 19, and before described; that is to say, in so far as regards the rails $D^1D^2$, and carriage E, and the parts in immediate and necessary connection therewith, the peculiarly formed sinkers *b b*, and the means employed to actuate the pressers *c c;* and whether such carriages travel in sets upon the same line of rails or on different lines of rails, disposed stepwise or in tiers.

9. The parts lastly before enumerated, each in itself separately and individually, so far as the same may be applicable to other machinery for the manufacture of looped or elastic fabrics.

10. The adaptation of the common warp frames to the production of braids, as before described.

11. The application of the compound guides L L, *l l*, to the common braiding machines.

12. The "turn-again loom," as before described; that is to say, in all that regards the arrangements or means by which the needles being disposed in a circle or polygon are worked in sections or divisions.

13. The improvements in the ordinary circular weaving loom, in so far as regards the division of the needles into sections, and the addition of the fixed bar of bobbins or warp beam, to throw in the independent tying, strengthening, and figuring threads.

14. The application of the last-mentioned method of throwing in independent threads into looping and elastic fabrics generally.

15. The improved construction of mainspring for stocking frames, as before described.

16. The new mode of constructing needle bars and point bars, and needle and point bars, as before described.

17. The improved machine bar, fitted with guides, points, and ticklers, as before described.

18. The improved mode of forming tucks in looped fabrics, as before described.

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SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 23RD, 1850.

GEORGE EDMOND DONISTHORPE, Leeds, and JAMES MILNES, Bradford, York. *For improvements in apparatus for stopping steam engines, and other first movers.* Patent dated November 17, 1849.

The object of this invention is to enable the superintendent of machinery, situated at a distance from the steam engine, or other first mover, to stop its action and momentum instantaneously, when required, without the necessity of communicating with the engineer. For this purpose the patentees propose to employ, in low pressure engines, a pipe which opens into the condenser at bottom, and communicates with the atmosphere at top. This pipe is opened and closed by means of a cock, placed in the upper part of it, on the spindle of which there is affixed a weighted lever. When the pipe is closed, and a vacuum established in the condenser for the working of the engine, the weighted end of the lever is supported in a horizontal line by a sliding plate on which the weight rests. The other end of the sliding plate is attached to a bell

crank lever to which wires are connected, which are carried into the different apartments, where the machines are placed, and there provided with pulls; so that when it is required suddenly to stop the engine, the person watching the machine will only have to move the pull near him, which will cause the sliding plate to be withdrawn from under the weighted end of the lever, which will then fall down into a vertical position, and opens the condenser to the atmosphere, whereby the vacuum will be destroyed and the machine instantly stopped. To prevent the engine being stopped without occasion or from wantonness, and to lead to the detection of the party doing so, there is a ratchet wheel, affixed upon the spindle of each pull, into which takes a spring click, whereby the pull will be prevented from returning to its first position until the click has been removed from the teeth. The ratchet wheel and spring click are enclosed in a box or case, to which the foreman of the establishment only can have access. The steam pipe is furnished with a valve, the spindle of which passes through a stuffing box outside the pipe, and is attached to one end of a weighted lever which oscillates on a pin, and is furnished at the other end with a socket whereby it may be connected to a standard by means of a pin and projecting piece, so as to keep the lever down and the valve up to allow of the free passage of the steam to the cylinder. This projecting piece is attached to one end of a bell crank lever —the other end being furnished with links through which a second lever passes, having a balance weight at one end and being connected by the other to the spindle of a valve which closes a tube opening into the condenser. The balance on the lever is so adjusted that the pressure upon the valve of the atmosphere against the vacuum in the condenser shall maintain the lever in a horizontal line; but when the pressure on both sides of the valve is equalized by the destruction of the vacuum, as was before explained, then the balance weight on the end of the second lever will act (drawing it down), and withdraw the projecting piece on the bell crank lever, whereby the socket of the first weighted lever will be set free, and will rise and consequently close the valve in the steam inlet pipe so as to cut off the steam from the cylinder.

In the case of high pressure engines, the apparatus in combination with the condenser is, of course, dispensed with, and the wires are connected directly to the bell crank lever.

To arrest the momentum of the fly-wheel when the engine is stopped, two bands are employed, which encircle it, and which are hinged together at bottom and connected together at top by an arm whch is centered on a spindle that has also keyed on it a weighted lever. This lever is supported in a horizontal line on a sliding plate attached to a crank lever, and the arm kept in a vertical line, whereby the bands are kept off the fly wheel. When the sliding plate is withdrawn the lever will fall, and bring the arm into another position, so as to bring the bands on the fly-wheel.

*Claim.*—The arranging and applying of apparatus in connection with and at a distance from a steam engine or other first mover, by the use of which, in case of accident or other sudden requirement, the action and momentum of the steam engine or other prime mover will be stopped.

THOMAS WORSDELL, Birmingham, Warwick, manufacturer. *For certain improvements in the manufacture of envelopes and cases, and in the tools and machinery used therein.* Patent dated November 17, 1849.

*Claims.*—1. A machine for shaping and cutting out envelopes; that is to say, in so far as regards the combination of the cutters with the centre plate of the ram; and whether these cutters are of the precise shape represented in the drawings which accompany the specification, or of any other suitable shape.

2. A machine for stamping, gumming, and "creasing" envelopes, and applying "adhesive" composition to the seal flaps thereof; that is to say, in so far as regards the combination in that one machine of the means of accomplishing these four processes, all or any two or three of them (the creasing always being one), partly simultaneously and partly continuously, but laying at the same time no claim to any one of the said processes separately and individually, except as afterwards excepted.

3. The working of the stamping die and gumming vessels in envelope-making machines by means of one cam or movement.

4. The combination in one machine of the two machines before mentioned, or of the parts peculiar thereto, by the continuous operation of which combined machine the shaping and cutting out, the stamping, the gumming, the "creasing," and applying the "adhesive" composition, may all be performed partly simultaneously and partly continuously.

5. The combination of the centre plate with recesses.

6. The addition to the second machine, and to the combination thereof with the second machine of flattening rollers and their immediate appendages.

7. The application of an under platform to the "creasing" of envelopes.

8. Keeping the seal flap elevated and

apart during the creasing and flattening processes, in order to have the adhesive composition applied thereto, and to prevent any of the other parts of the envelope, or any parts of the machinery, from coming in contact with the said composition; also the applying of the adhesive composition to the seal flaps, while the creasing or other operations is or are in progress.

9. The use of oscillating and stationary vessels for applying the adhesive composition to the seal flap.

10. A peculiar construction of "creasing" apparatus.

11. An assorting apparatus.

We shall give a full description of this machine with engravings in our next number.

C. L. A. MEINIG, of Hamburgh, now residing in London, merchant. *For certain improved modes or methods of applying galvanism and magnetism to curative and sanatory purposes.* Patent dated November 17, 1849.

*Claims.*—1. The employment for curative and sanatory purposes of portable electromagnets, constructed and operated with in a peculiar manner, which the patentee fully exemplifies and describes.

2. Employing for the said purposes the influence of portable magnets, protected from oxidation by a thin coating of gold or gutta percha, or other like incorrodible and not easily permeable substance.

3. The combination of portable magnets, or electro-magnets, and portable galvanic apparatuses, for the purposes aforesaid.

4. The producing long-continued galvanic or magnetic effects on animal bodies by means of portable galvanic apparatuses attached to such bodies (but independent thereof for their moist element).

5. The producing magnetic effects on animal bodies, or parts thereof, by transmitting electric currents along or around the surfaces thereof by portable conducting apparatuses.

6. The application of portable magnetic apparatuses to animal bodies in such manner that one, or principally one, polarity only of magnetism shall act on each of two different parts of the said bodies, and so also that either one and the same polarity shall affect both parts, or a positive polarity affect one part and a negative polarity the other, wholly irrespective of the distance between those parts and of their relative positions.

7. The producing a long-continued effect of one, or principally one, polarity only on certain parts of animal bodies, by means of portable transversal magnets, or by portable magnets applied perpendicularly or at right angles.

8. The application of galvanic currents (generated by such portable galvanic apparatuses as are described under the third head) to exert a magnetic influence on animal bodies (as explained under the fifth head), by certain peculiar modes or methods, the description of which forms the eighth or last head of this specification.

CHARLES JAMES POWNALL, Kensington, Middlesex, esquire. *For a certain mode or method, or certain modes or methods, of ascertaining and registering the number of persons entering in or upon passenger conveyances, and passenger ways, and the instruments or apparatus for effecting the same.* Patent dated November 17, 1849.

*Claims.*—1. A method of causing the entrance of every person into or upon a carriage or other conveyance, or upon any passage way, to complete an electric circuit in connection with a voltaic battery, and such completion of the circuit to actuate a system of wheelwork and numbering index, or electro-magnetic and dotting pointer, connected therewith.

2. The construction of the steps of, or entrance-ways into or upon carriages, of two separate leaves or plates, by the pressing together of which a metallic circuit is completed, in connection with a voltaic battery.

[We shall give full particulars of this ingenious invention in a forthcoming Number.]

JOHN WEBSTER HANCOCK, Melbourne, Derby, manufacturer. *For improvements in the manufacture of hosiery goods, or articles composed of knitted fabrics.* Patent dated November 17, 1849.

The patentee describes and claims—

1. Manufacturing gloves or mitts, or coverings for the hands, wrists, or arms, of knitted fabrics having on the inside a cut-pile or velvet surface.

2. Making cut-pile fabrics or velvets in a warp machine by double-lapping some or all of the threads.

3. A peculiar arrangement for forming the pile by a draw-cut, and cutting in larger pieces than has hitherto been customary; also the use of a stretcher, or other analagous apparatus to be used in combination with the preceding or other arrangements for holding the wire while the loops are formed.

4. A peculiar arrangement for cutting the pile by means of knives arranged in leads, and giving the knife-bar a slogging or lateral movement to shift the position of the knives at the end of each course; and, lastly, a peculiar form of knives, and the mode of mounting them in the bar, together with a method of adapting them to their work so that any length of loop may be formed and cut with facility.

Louis Adolphe Duperrey, 112, Faubourg du Temple, Paris, France, engineer. *For certain improvements in machinery for producing figures in relievo.* Patent dated November 17, 1849.

This invention consists in the construction of four different machines for reproducing models sculptured in basso relievo or in relievo, either in similar or different proportions, or with one proportion of the model altered, and the rest unchanged.

The claims refer to the construction and adaptation of parts which constitute these machines, as described in the specification and represented in drawings which accompany it.

William Brindley, Nelson-terrace, Twickenham, Middlesex, *papier-maché* manufacturer. *For improvements in producing ornamental designs on papier-maché, and in preserving vegetable matters.* Patent dated November 17, 1849.

The improvements sought to be secured under this patent consist—

1. In using the sheets of wet paper without their being pressed, as usual, before accumulating them on the pattern, in order to obtain sharper impressions from the leaves, flowers, and stalks of plants than has hitherto been practicable. For this purpose, the pattern is covered with oiled paper, and the sheets of wet paper laid upon them, after which the pattern and paper are subjected to pressure, clamped together, and then stoved. The pattern is formed by laying the flowers and leaves on a panel board. The impressions thus produced may be used as moulds, or by japanners.

2. To preserve vegetable substances, the patentee proposes to oil and stove them in the same way as articles made from *papier-maché.*

*Claims.*—1. Producing ornamental surfaces on *papier-maché* by employing unpressed wet paper; also the employment of the leaves of plants or flowers, or parts thereof, for producing ornamental surfaces on *papier-maché.*

2. The pressing (*query* preserving) of vegetable substances such as the leaves and flowers of plants.

Samuel Stocker, High Holborn, Middlesex, hydraulic engineer. *For improvements in the beer engines, beer measures, and tobacco-boxes used by publicans.* Patent dated November 17, 1849.

The patentee describes and claims—

1. Various modes of constructing barrel-engines, in order that, when not working, the openings may be covered.

2. Making anti-corrosive barrels by lining them with wood, marble, or slate.

3. Ornamenting barrels by covering them with ornamented paper.

4. Making the feet and handles of beer-measures and pots of iron or brass, stamped into shape, in order that they may last the longer, and offer greater obstruction to the breaking up and concealment of them when stolen.

5. Making the pots of less thickness than hitherto, and covering them externally with paper, to diminish their value, and consequently the risk of their being stolen.

6. A construction of tobacco-box, having for its object to prevent customers helping themselves to the tobacco without paying for it, which consists of a casing that encloses a disc, perforated with holes equidistant apart, to contain separate parcels of tobacco. The front face of the casing has one hole, only large enough to allow of one parcel being withdrawn. To the back of the disc there is affixed an escapement, which consists of two wheels, the large one having teeth on the inside circumference, and the small one on the outside—the number of teeth in each being equal to the number of holes in the disc. Behind the disc there is a lever, which is pressed up by a spring so as to project its extremity into the money channel, which leads from an opening in the top of the casing to a receptacle in the lower part. The lever carries at top a detent, which takes into the teeth of both wheels, and the resistance of the spring is calculated so that when a certain coin — a penny-piece, for instance — is dropped in, the lever shall give way before it, allowing it to pass into a drawer or receptacle, and, at the same time, the descent of the lever will cause the detent to take into the space between two teeth of the small wheel, and move it one tooth on: the reaction of the spring will move the lever back, and cause the detent to take into between two teeth in the large wheel, and move it one tooth forward. The result of this operation will be to bring the succeeding tobacco-holder opposite the opening in the face of the casing.

William Buckwell, of the Artificial Granite Works, Battersea, Surrey, engineer. *For improvements in manufacturing pipes and other structures artificially in moulds, when using stones and other matters.* Patent dated November 17, 1849.

Mr. Buckwell proposes to manufacture stoneware pipes by percussion or impact, by a process similar to the one he employs for the compression of artificial fuel (see vol. li., p. 328). For this purpose he employs a cast-iron mould, and a ram or steam hammer. Supposing the pipe which is to be made is of 4 feet diameter, and of a sectional area equal to 400 square inches, the hammer should weigh two tons and a half, make 50 strokes a minute, and move through

a space of 4 feet. The materials which are to be fed into the mould, little by little, after each stroke, until the pipe is completed, are composed of 1 part of Portland or other suitable cement, 3 parts of stone, and about 5 per cent. of liquid. But the proportion of the liquid will depend upon the degree of absorbence possessed by the stone, the state of the atmosphere, &c., and can only be determined by experience. For instance, if there be too little water, the stone will powder under the blows of the ram, and if there be too much, it will appear on the surface. When it is required to make more than one pipe in a mould of greater length than the hammer can work in, or to produce a longer pipe than it is calculated to make, it is proposed, in the first instance, to place iron rings in the mould at each length of pipe, which shall fit it accurately, and respectively serve as bottoms to the pipes. In the second, the use of the rings is dispensed with. In both cases the ring which forms the under part of the mould at commencement is supported on a platform, which rests upon the piston rod of a steam cylinder, so as to bring the materials of which the pipe is to be made within the range of the hammer. This platform is locked at commencement, and kept so until the pipe or portion of pipe in the mould is completed, when it is unlocked, and the pipe allowed to descend. A similar arrangement is adopted to support the core. When solid structures are to be made, the use of the core is dispensed with.

To unite these pipes, which from the manner they have been made are necessarily without projections, or other similar shaped pipes, whether of metal or not, the patentee proposes to employ a metal band, having an internal flange and tangential bolt-holes, which is of less internal diameter than the external diameter of the pipe. A strip of vulcanised Indian rubber or gutta percha is laid over the joint, and over that the band, which is made to hold the pipes tightly by screwing up the bolt.

*Claim.*— Compressing or solidifying in moulds, by impact or percussion, cylindrical structures called pipes, or other structures where stone or other matter is employed, and also the mode of uniting or joining pipes made without projections by means of an expanding and collapsable metal band.

Alfred Vincent Newton, Chancery-lane, mechanical draughtsman. *For improvements in manufacturing leather.* (A communication.) Patent dated November 17, 1849.

The patentee states that the object of this vention is to effect the tanning of leather ore speedily than has yet been accomplished, and at the same time to improve the quality of it. With this view, he takes for every 100 calves' skins, unhaired and freed from lime,

20 lbs. of sulphate of alumina and potash (alum), and 10 lbs. of chloride of sodium.

100 lbs. of mimosa catechu.

4 lbs. of sulphate of alumina, either alone or mixed with 2 lbs. of chloride of sodium.

The three mixtures are dissolved in water, and kept apart in different vessels.

Of the first mixture one-fifth, of the second one-tenth, and of the third one-fourth are placed in a vat, and the skins put in. While immersed they are pushed round the vat by men armed with poles, or by machinery. After a short time the skins are taken out, and one-fifth of the first mixture, one-tenth of the second, and one-fourth of the third added to that in the vat. The skins are again immersed and treated as before. After a longer period than in the former case, they are taken out, and one-fifth of the first mixture and one-tenth of the second mixture poured into the vat. The skins are again immersed, and allowed to remain in some time, being occasionally stirred round. They are again removed, and the remainders of the first and third mixtures, and one-fifth of the second mixture, are added, and the skins immersed; after some days, the remaining two-fifths of the second mixture are added. In the course of four or five weeks the skins will be found completely tanned.

As a modification of the preceding process, it is suggested to lay the skins in a pit, with about 3 lbs. of bark between each, and mixed with water. The pit is to be provided with a hand pump, for pumping the tanning-liquid from the bottom on to the top skin.

The following proportions are given by the patentee :—

For 100 goat skins, 10 to 12 lbs. of sulphate of alumina and potash, 6 lbs. of chloride of sodium, and from 50 to 60 lbs. of mimosa catechu.

For 100 cow-hides—200 to 300 lbs. of sulphate of alumina, 100 lbs. of chloride of sodium, and 500 lbs. of mimosa catechu.

For 100 ox-hides—14 to 16 lbs. of sulphate of alumina, 8 lbs. of chloride of sodium, 12 to 14 lbs. of mimosa catechu. From 50 to 60 lbs. of the latter are subsequently added.

*Claim.*—The manufacturing leather by effecting the tanning operation in the following manner, viz.: by employing substances to act directly on the albuminous matter of the skins, such as sulphate of alumina, sulphate of alumina and potash (alum), chloride of sodium, sulphate of magnesia, sulphate of aluminum, chloride of zinc, &c., and substances containing tannin, to act upon the gelatine of the skin,

such as the mimosa catechu, bark and leaves of oak, the bark of poplar, chestnut, spurge laurel, sumach, &c., according to the proportions and processes before described, taking for a standard, mimosa catechu of good quality, which contains 50 per cent. of tannin.

Charles Cowper, Southampton-buildings, Chancery-lane. *For certain improvements in the manufacture of sugar.* Patent dated November 20, 1849.

This invention relates to the treatment of cane juice, beetroot juce, or other saccharine liquid with caustic baryta, and to the recovery of it from the carbonate of baryta, which is formed by this operation.

The cane juice, or other saccharine liquid, is heated to 167° Fahr., and caustic baryta, previously slacked and mixed with a sufficiency of water to reduce it to the consistency of cream, is added in the proportion of 60lbs to 100 gallons of juice. This mixture is then raised to the boiling point, when the baryta and sugar precipitate in the form of saccharate of baryta, and the superabundant liquid is decanted off. The sugar will be thus separated from its impurities, which will be held in suspension by the water. The precipitate is to be washed and subjected to pressure to expel the moisture, when it will assume the appearance of cakes. Or may remain in the state of magma or thin paste. The cakes are broken into small pieces, and mixed with one and a quarter their weight of water; or in case of the precipitate being a magma it is mixed with a quantity of water sufficient to produce a similar result. Carbonic acid is now passed through the mixture, whereby the sugar will be liberated and held in solution by the water, while the baryta will be precipitated in the form of carbonate of baryta. The saccharine solution is drawn off and concentrated by boiling to 1·27° specific gravity, when the syrup is filtered, to obtain the baryta which will be precipitated by heat, and concentrated to the crystallizing point. It is lastly poured into vessels and allowed to crystallize. The solutions which have been drawn off may be turned to account by concentrating them to 1·27° specific gravity (filtering as before) and converting them to alcohol by fermentation. The locality of the works may sometimes render it desirable to employ some other base than baryta, such as strontia or oxide of lead, capable of forming an insoluble saccharate; and in some cases it may be advisable to form first a soluble saccharate which is afterwards converted, by double decomposition, into an insoluble saccharate —the soluble saccharate being mixed with the solution of a salt capable of forming an insoluble saccharate and a soluble salt. Instead of carbonic acid, sulphuric, phosphoric, or boracic acid may be used, provided it will precipitate with the baryta and liberate the sugar. The process just described may be applied to the treatment of raw sugar by dissolving it in water, and adding caustic baryta; proceeding with the rest of the operation as before. Instead of caustic baryta, its equivalent of hydrate of baryta may be used.

To recover the caustic baryta from the carbonate of baryta, the patentee proposes to employ either of the following two processes.

1. The carbonate of baryta is treated with sulphuric acid in a close vessel to form sulphate of baryta, and the carbonic acid which is thereby disengaged, is preserved and subsequently applied to the treatment of the saccharate of baryta. The sulphate of baryta is converted into sulphuret of barium, by heating it with charcoal, or other carbonaceous matter in a furnace; or when it is desired to collect the carbonic acid, in a retort, the sulphuret of barium is separated from the carbon by washing, and will consequently form a solution which is to be boiled with the oxide of copper. The resulting products will be sulphuret of copper and hydrate of baryta. The sulphuret of copper is reconverted into oxide of copper by roasting, in order that it may be rendered available again.

2. The object of this process is to separate the caustic or hydrate of baryta from carbonate of baryta by double decomposition. For this purpose any of the sulphates may be employed—some in a dry and some in a wet state—but the patentee prefers to use sulphate of soda or potash, because it may be converted into a more valuable form, caustic soda, or potash, or carbonate of soda, or potash. The mode of operating with sulphate of soda is the same as that for sulphate of potash, with the exception that 218 parts of the latter are to be employed instead of 178 of the former. If it were not desired to effect a complete decomposition it would simply be necessary to mix one chemical equivalent of sulphate of soda with one chemical equivalent of carbonate of baryta, in which case there would be formed on the one hand a mixture of sulphate of baryta, formed by decomposition, with an undissolved carbonate of baryta, and on the other, a solution of carbonate of soda, formed by decomposition, with an undissolved sulphate of soda. It is, therefore, proposed to employ the dissolving salt, in excess in proportion to the salt to be dissolved. Also, if it is desired to separate the last portion of sulphuric acid it is necessary to use a substance (by preference lime) which will combine with the carbonic acid as it is set free by the sulphuric acid and form a carbonate.

First operation.—178 parts by weight of sulphate of soda are dissolved in three times its weight of water, mixed with 123 parts of carbonate of baryta, and boiled two hours, whence will result a solution of carbonate and sulphate of soda, and a precipitate of sulphate of baryta, which is to be washed and set aside to be afterwards converted into sulphuret of barium. The washings are also to be preserved and used in the subsequent operations.

Second operation.—The solution of carbonate and sulphate of soda, resulting from the first operation, is mixed with 246 parts of carbonate of baryta and 71 parts of lime. The mixture is boiled for about two hours and then allowed to precipitate, when there will be formed a carbonate and sulphate of baryta and a carbonate of lime. The solution is to be decanted off, and may be converted into caustic, or carbonate of soda.

Third operation.—This precipitate is mixed with the same quantity of sulphate of soda as was used in the first operation, dissolved in the washings before referred to, and the mixture boiled for two hours, when the sulphate of baryta and carbonate of lime will be precipitated, and the supernatant solution of sulphate and carbonate of soda is drawn off, and employed for the second operation. The precipitate, sulphate of baryta, and carbonate of lime, is mixed with carbonaceous matters, and heated to redness in a retort, or closed vessel, to collect the carbonic acid gas that will be disengaged from the lime, and by the reaction of the carbon on the sulphate of baryta, and which, after being washed, is to be employed to decompose the saccharates of baryta. The resulting products will be sulphuret of barium, lime, and carbon, which are to be washed; when the sulphate of barium will be separated from the lime and carbon, and be held in solution, which is to be converted into hydrate of baryta, in the manner before described.

*Claim.*—The recovery of baryta from carbonate of baryta, formed in the manufacture of sugar by decomposing it with sulphuric acid.

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## *Specification Due, but not Enrolled.*

Charles Edouard Francois Constant Prospere De Changy, Brussels, now residing in Tavistock-street, Westminster, civil engineer. *For improvements in the preparation and manufacture of flax, hemp, and other like substances.* Patent dated November 20, 1849.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in warming and ventilating buildings. (Communication.) May 22; six months.

Robert Cotgreave, of Eccleston, Chester, farmer, for certain improvements in machinery or apparatus to be used in draining land. May 22; six months.

Henry Columbus Hurry, of Manchester, civil engineer, for certain improvements in the method of lubricating machinery. May 22; six months.

William Palmer, of 14, Cottage Grove, Bow-road, Middlesex, gentleman, for improvements in the manufacture of candles and candlewick, and in the machinery applicable to such matters. May 22; six months.

Jules Frederick Maillard Dumesk, of Paris, for certain improvements in reflectors for luminaries. May 22; six months.

Simon Pincoffs, of Manchester, merchant, for certain improvements in the dyeing process in calico printing and dyeing, which improvements are also applicable to other processes in calico, printing and dyeing. May 23; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| May 16 | 2303 | W. Baddeley | Alfred-street, Islington | Portable fire-engine. ("Every man his own fireman.") |
| ,, | 2304 | Capper and Waters | Regent-street | Combined jacket and shirt. (Carlisle jacket.) |

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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1399.] SATURDAY, JUNE 1, 1850. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.


## WORSDELL'S PATENT ENVELOPE-MAKING MACHINERY.

Fig. 1.

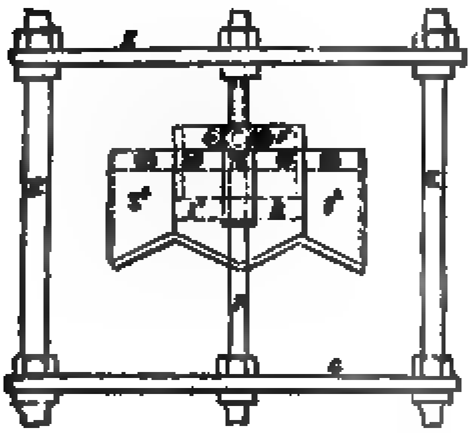


Fig. 2.

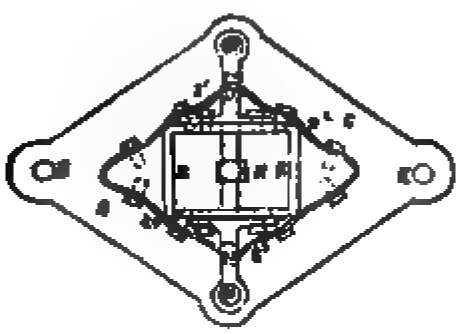
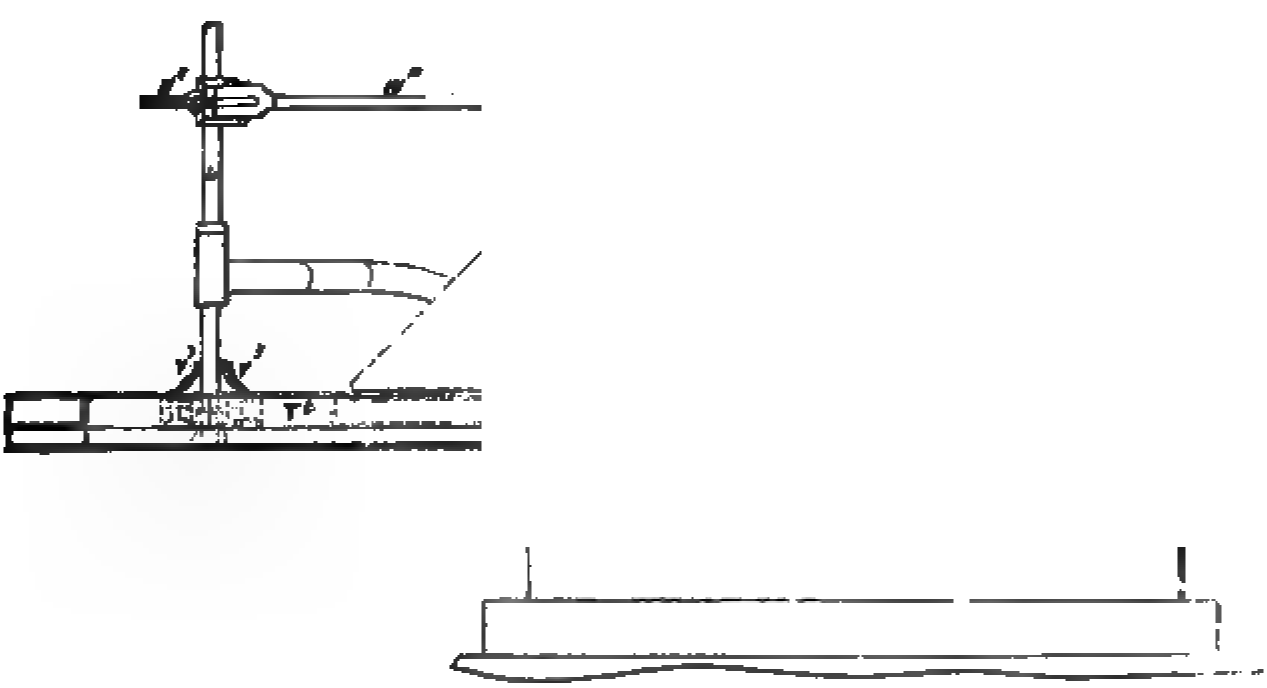


Fig. 3.



WORSDELL'S PATENT ENVELOPE MAKING MACHINERY.

[Patent dated November 17, 1849. Patentee Thomas Worsdell, Birmingham, manufacturer. Specification enrolled May 17, 1850.]

ACCORDING to the mode in which envelopes are now ordinarily manufactured, they have to pass through a number of distinct processes, with intervals more or less dilatory between them, before they attain to a finished state; and those processes are accomplished partly by hand and partly by machinery. Now the improvements which form the subject of the present patent consist, *firstly*, in an arrangement and combination of machinery, or of machines, in serial order, "whereby some of the said processes are performed simultaneously with others of them, and the whole are performed in continuous or uninterrupted succession by means of machinery chiefly, with as little aid as may be from hand-labour, and with much greater dispatch than heretofore, and whereby also the cost of manufacturing the same is greatly reduced." And, *secondly*, in certain improvements peculiar to parts of the said processes, machinery, or machines, and to certain of the tools used therein or therewith, "which improved parts of the processes, machinery, or machines, or tools, may (some or all of them) be used by themselves, separately from, and independent of the serial order and arrangement aforesaid."

The processes referred to by the patentee consist, 1st., of the shaping and cutting; that is, the cutting out from sheets or webs of paper pieces of the shape or contour of the envelope when spread out flat. 2nd. In stamping the projecting part of that side of the piece so cut out, which is afterwards to form the seal flap of the envelope, with any required device. 3rd. In gumming the edges of two of the other sides, which are afterwards to form the end flaps of the envelope. 4th. In what is called creasing the piece of paper, or, in other words, indenting it in rectangular lines, so as throw up the four sides which are to form the four flaps. 5th. In applying to the under part of the seal flap an "adhesive" composition. 6th. In pressing down and flattening the three sides which have been prepared for being cemented together; and, 7th. In arranging a number of such envelopes into lots of determinate numbers as they emerge from the pressing and flattening rollers.

The details of these processes, and the improvements which Mr. Worsdell has effected in each are thus described:—

*The Shaping and Cutting-out Processes.*

I perform these operations by one machine, and by one continuous movement of that machine. Fig. 1 is a side elevation of this instrument, which I call a "cutting ram," and fig. 2 a plan thereof. E E is a framework, and F the ram which moves up and down on the pillars, P P. The centre plate R of this ram is of the same rectangular area as the back of the envelope intended to be manufactured, and has four cutters, $S^1$, $S^2$, $S^3$, $S^4$, projecting downwards from it, which are of the exact shapes of the four flaps of the future envelope. Each of these sides is formed with knife-edges or has knife-edges inserted into it, which act after the manner of shears in cutting the paper. G is a table on to which the web of paper is fed, from which the envelope, and a succession of such envelopes, is cut out. H is a rectangular recess in the centre of the table, of a size a little larger than the centre plate R of the ram. The cutting ram is lowered and raised by means of a crank and fly-wheel, and the paper is fed into the machine by two rollers, which are acted on by a cam in such manner as to give an intermittent motion to the web, so that at each elevation of the ram, a fresh length of paper, sufficient to make an envelope, shall be fed in (the two last parts of the machines are omitted in the drawings). The mode of operation is as follows: On the web of paper being brought upon the table G, the ram is lowered, when the four extreme points of the knife-edges, $S^1$, $S^2$, $S^3$, $S^4$, simultaneously penetrate the paper, and by their joint action, as the ram descends, cut out from the web a piece of the form of the intended envelope, when spread out flat. As soon as the knife-edges have thus performed their office, the centre plate R (the ram still continuing to descend) comes in contact with the piece of paper which has been so externally shaped and cut out, and carrying it down through the recess, gives to the centre of it, the rectangular form of the centre plate R and recess H—that is to say, a form suitable for the back of the future envelope; and throws up at the same time the four sides which are destined to form the end and side flaps into nearly a perpendicular position. On the ram completing its stroke, the roughly-shaped envelope drops out at bottom into a receiving tray.

*The Stamping, Gumming, Creasing, and Adhesive Composition, Applying Processes.*

The whole of these four processes I perform by the continuous operation of one machine, of which a front elevation is given in fig. 3, a back elevation in fig. 4, and a side view in fig. 5. To some extent this machine is precisely similar to the shaping and cutting machine previously described; and in practice I prefer combining the two machines in one,

Fig. 4. Fig. 5.

which shall do the work of both. E E is a framework; F a ram with centre plate R; and G a table with rectangular recess H, all as in the machine before described. I is a shaft carrying an eccentric K, which is worked by a band on the pulley M, and gives motion to

the ram. L is a fly-wheel. N, N, N, N, are four guides, between which the piece of paper is placed ready to be acted on by the ram. O is a slide, to the bottom of which is attached a die or stamp Q. $R^a$ $R^a$ are the gumming vessels which are attached by stays, *r r*, to the slide O. X is a cam on the shaft I, which acts upon the roller Y, which presses down the slide O. The gumming vessels, $R^a R^a$, consist each of a small cylinder, into which a piece of sponge or other suitable porous material is closely fitted. *r′r″* are two small taps by which the flow of the gum is regulated. $T^1$, $T^2$, $T^3$, $T^4$, are four metal creasing plates which are suspended from a frame, $F^2$, and when hanging, nearly coincide with the four sides of the recess H, inclining slightly inwards.

A view of these plates, and the frame which supports them, is given separately in fig. 7. V is an oscillating reservoir containing the adhesive composition, which is connected to the centre plate by the slotted bracket *v*. B is an under platform which has a rising and dropping motion given to it by arrangements to be presently explained. When it rises, it acts in combination with the centre plate R to press the paper into the required form, and when it drops into an inclined position it serves to deliver the paper after it has been stamped, gummed, and creased, into a trough Z. It is centred on the top of a bent lever $b^a$, which has at bottom a spring $c^a$, and this bent lever $b^a$ is connected to the under end of another lever $e^a$, which passes upwards to near the shaft I, where it is surmounted by a roller $f^a$, which is acted on by a cam $g^1$ on the shaft I. When the cam is in one position it depresses the lever $e^a$, and consequently the lever $b^a$ and the spring $c^a$, which allows the platform to fall into the inclined position, as represented in fig. 7; and when the cam taking another position, sets free the spring $c^a$ and lever $b^a$, the platform is thrown up by the action of the spring and of the tail pin $h^a$ into a horizontal position.

The mode of operating with the machine is as follows:—The paper being laid on the table within the guides N, and the shaft I made to revolve, the cam X, acting on the roller Y, first depresses the slide O, which brings the stamp Q down on the end of the seal-flap, and simultaneously therewith the mouths of the gumming vessels $R^a$ upon the edges of the two end flaps, immediately after which these tools are returned to their original position by the action of a spring W. Two horizontal stops $A^a$ prevent the paper from being touched by the gum at any but the desired points. The centre plate (R) of the ram comes next in contact with the centre of the piece of paper, and presses it down through the recess H, throwing up the four sides into nearly a perpendicular position, as explained in the description of the shaping and cutting-out machine. The motion of the ram being continued, the paper is forced down between the creasing plates $T^1$, $T^2$, $T^3$, $T^4$, the springs *t t* at the back of these plates giving way accordingly. The adhesive composition reservoir V, descending along with the ram comes now in contact with the edge of the recess H, which causes it (the reservoir) to tilt in the direction shown in the engraving, fig. $7^a$, and thus to bring a sponge (which is fitted into the lower part of the reservoir, and through which the composition flows) into contact with the inner side of the seal-flap; and any further descent of the reservoir being stopped by the table, the paper is drawn down through the remainder of the distance between the gummed sponge and the metal plate $T^1$, whereby the gum is laid upon the paper to the extent required. When the ram reaches the lowest point of its stroke, the centre plate (R) and paper are met by the ascent of the under platform B, which is supposed to have just previously discharged an envelope into the trough Z. The ram now commences its return or up-stroke, leaving the paper detained by the pressure of the four creasing plates, which, as soon as the ram rises above the points *z z*, return to their original positions by the action of the springs (*t t*) behind them. The four sides of the paper are at this time slightly inclined inwards at an angle regulated by the set screws $k^a$ $k^a$. When the ram in its ascent reaches above the highest points of the upright sides of the paper, the under platform B is made to fly up and press the edges of the paper against the bottom edges of the four creasing plates, which serves still further to impress the paper into the required form. The manner in which the last movement of the under platform B is produced, is as follows. In the side of $b^a$, the spring lever, on the top of which the platform is centred, there is a notch $m^a$, cut into which a spring sliding bolt $n^a$ fits, and during the previous or first ascent of the under platform, that bolt is left in the notch, which necessarily limits the height of the ascent to the height of the notch. But on the farther ascent of the ram, the sliding bolt $n^a$ is acted upon by a cam $p^a$, attached to a shaft $C^c$, which is worked from a crank pin $D^a$ on the main shaft I, and is thus withdrawn from the notch, which allows the bent lever $b^a$ to ascend to its full extent.

### *The Pressing and Flattening Processes.*

The partially-formed envelope, after having been stamped, gummed, and creased, and had the adhesive composition applied to it as before described, is removed to the flattening

rollers. This is effected by the cam $g^a$ coming in contact with the roller $f^a$, and depressing the rod $e^a$ and spring $c^a$, which forces down the lever $b^a$, when the platform drops into an inclined position, and the envelope slides off the platform into the trough Z, and thence beneath a cross guide S' between the rollers R' R'. The under roller is driven by a pulley and band from the main shaft I. The upper one is driven by frictional contact with the lower one, and is shorter than the lower roller, to allow the seal-flap of the envelope to pass without being flattened, whilst the remaining three sides are drawn between the rollers and flattened; the gum which has been laid on the two end flaps, as before described, is pressed by the rollers down upon the side-flap (opposite to the seal-flap) and all three are thus cemented together.

*The Assorting Process.*

Upon emerging from the rollers, the envelope descends of its own weight further down the trough, and then drops into a revolving receiver, which carries two semicircular trays. The receiver has an upright spindle fitted with a ratchet wheel, which is worked by a rod from a crank-pin on the main shaft, and makes at each movement of a tooth, a stroke equal to one twenty-fifth part of the circumference of one of the trays; and the rate at which the receiver revolves is so adjusted, that at every advance of a tooth there shall be a new envelope ready to drop into the trays, which operation goes on continuously until both the trays are nearly filled. The envelopes are then carried away to a suitable place for drying, and the tray replaced in its original position on the table, ready for further use.

From the description which has been thus given of the series of processes through which the envelope is passed, it will be readily understood that, though it will be generally preferable to employ the whole series, yet that several of the series may be left out without prejudice to others. For example, the stamping die, or the gumming vessels, or the adhesive composition reservoir, with their respective appendages, may be left out of the machine represented in figs. 3, 4, 5, and 6, all or any of them, and that machine employed for creasing only, or for creasing in combination with any one or more of the other processes. So also, the flattening rollers may be dispensed with, in which case the envelopes would be creased only, but creased to such an extent that the sides would incline so far inwards as to be easily laid flat by hand.

## METEOROLOGY.—THE BRITISH METEOROLOGICAL SOCIETY.

One of the peculiarities of this country is, the almost incessant variation of its climate. This continual fluctuation is attributable to the geographical position of the island—especially to its contiguity to an extensive continent on one side, and to a vast ocean on the other. Great Britain has always been noted for its changeable climate: Tacitus tells us —"*Cælum crebis imbribus ac nebulis fœdum: asperitas pigorum abest.*" Cæsar says—"*Loda sunt temperatoria quàm in Galliâ, remissioribus pigoribus.*" This arises, no doubt, from the insular situation of the country. Although the peculiarity which Tacitus ascribed to the climate of the island eighteen hundred years ago, might now be generally attributed to it, still it is highly probable that the large extent of country now cultivated, compared with the cultivated parts in the time of Tacitus and Cæsar, has occasioned a considerable alteration in our climate; as it is an established fact, that the change from uncultivated waste or forest to a state of cultivation, renders the climate warmer and more salubrious. But be this as it may, we have no certain data by which we can determine whether any change has taken place in the general climate of the country since the epoch named, or not; if it have, the extent of that change, and the manner of its accomplishment, are alike unknown.

Seeing how many singular characteristics belong to the climate of Britain,—how much the health of the inhabitants and the productions of the land depend upon the climate,—taking into account, moreover, the philosophic and inquiring spirit which has for centuries distinguished the English people,—it is unaccountably strange that the climatology of the country has been so generally neglected. True it is, that the various indications of barometers and thermometers have been registered in isolated cases—the depth of rain, the quantity of dew, the direction of wind, &c., &c., &c., have been noted; but these observations, though to some ex-

tent useful, have been quite inadequate to settle any laws respecting the diurnal or semi-diurnal fluctuations of the atmosphere: no systematic plan has been adopted to note and register meteorological occurrences throughout the country, so that probable inferences may be safely drawn from them, or general laws established by them. Up to a very recent date, no statistical data were in existence by which many meteorological phenomena could be submitted to accurate calculation; only approximate results could be obtained, the best of which rested on fortunate guesses. This applied even to particular districts; any general average of the whole, it is clear, must be taken under a still more qualified restriction. Wells, Dalton, Howard, and some others have successfully laboured in many branches of meteorological science; but not until very lately has any general scheme been made practical.

It must be obvious that no general laws, with respect to any branch of meteorological science, can be safely established, unless it be founded upon careful statistical facts, ascertained simultaneously in various parts of the country; it is therefore equally manifest that no single individual exertion can accomplish this indispensable preliminary: it must be the work of various parties situated in different localities. Hence, the difficulty of taking the first step appears to afford some reason why it is that so little progress has been made in meteorological science, so as to make its importance at once evident and serviceable.

At the meeting of the British Association at Plymouth, in 1841, the celebrated Quetelet, the Astronomer Royal of Belgium, pointed out the necessity of establishing as complete an enumeration as possible of periodical phenomena. With respect to meteorology, he advised that the following points should be attended to by various observers at the same time, in various parts, so that the laws of dependence and of correlation which exist between the different phenomena might be ascertained, namely—

"Pressure of the air during different months.

"Temperature.

"Humidity.

"Electricity.

"Force and direction of the winds.

"Quantity of rain, snow, &c.

"State of the sky.

"Meteors (shooting stars, *auroræ borealis*), &c."

Since this philosophic suggestion was thrown out, a scheme has been devised to supply the *desideratum* which had so long existed in this country. The plan was, to induce gentlemen in various parts of the kingdom to procure instruments properly adjusted, and to have observations duly made at given times of the day: to tabulate those observations, and to send them constantly to the Royal Observatory, Greenwich—where a meteorological department has been established, under the superintendence, of course, of the Astronomer Royal, whose chief assistant in this part is James Glaisher, Esq., F.R.S., on whom has devolved the whole management. The plan was an admirable one, and it has been met in a spirit that deserves and commands success.

The names of the stations and the observers are the following:—

| *Stations.* | *Observers.* |
|---|---|
| Guernsey | Dr. Hoskin, F.R.S. |
| Helston | M. P. Moyle, Esq. |
| Falmouth | Lovel Squire, Esq. |
| Truro | Dr. C. Barham. |
| Exeter | Dr. Shapter. |
| Chichester | William Hill, Esq. |
| Uckfield | C. L. Prince, Esq. |
| Southampton | John Drew, Esq., F.R.A.S. |
| Greenwich Observatory | The Astronomer Royal. |
| Maidstone-hill, Greenwich | Mr. William Ellis. |
| St. John's Wood | George Leech, Esq. |
| At Messrs. Whitbread's Brewery, Chiswell-street, London. | Messrs. Slate & Richardson. |
| Latimer Rectory, (Bucks) | Rev. Samuel King, F.R.A.S. |
| Aylesbury | Thomas Dell, Esq., F.R.A.S. |
| Stone Observatory | M. Fasel, Assistant to the Rev. J. B. Reade, F.R.S. |
| Hartwell, near Aylesbury | Mr. Horton, Assistant to Dr. Lee, F.R.S. |
| Saffron Walden | T. Spurgen, Esq. |
| Radcliffe Observatory, Oxford | M. J. Johnson, Esq., M.A., F.R.A.S. |
| Rose Hill (near Oxford) | Rev. John Slatter, F.R.A.S. |

| *Stations.* | *Observers.* |
|---|---|
| Cardington (near Bedford) | Mr. Maclaren, Gardener to S. C. Whitbread, Esq., F.R.A.S. |
| Norwich | William Brooke, Esq., F.R.A S. |
| Holkham | Samuel Shellabear, Esq., Assistant to the Earl of Leicester. |
| Highfield House (Notts) | Messrs. E. J. & A. S. H. Lowe. |
| Derby | Mr. J. Davis, Optician. |
| Manchester | George V. Vernon, Esq. |
| Hawarden (near Chester) | Dr. Moffat, F.R.A.S. |
| Liverpool Observatory | John Hartrup, Esq., F.R.A.S. |
| Wakefield Prison | R. Milner, Esq. |
| Stourton Lodge (near Leeds) | Charles Charnock, Esq. |
| Stonyhurst Observatory | Rev. Alfred Weld, F.R.A.S. |
| York | John Ford, Esq. |
| Whitehaven | John Fletcher Miller, Esq., F.R.A.S. |
| Durham | R. C. Carrington, Esq. |
| Newcastle | G. Muras, Esq. |
| North Shields | Robert Spence, Esq. |
| Glasgow | Dr. Dundas Thompson. |

Each of these observers is provided with a set of barometers and thermometers of the most approved construction, and duly adjusted; most of them, we believe, have been personally tested by Mr. Glaisher. They have also rain gauges for ascertaining the quantity of rain that falls, and instruments for showing the force and direction of the wind. The quantity of dew is observed; the clouds are daily noted; and any other meteorological phenomena duly registered. The results thus obtained are regularly transmitted to the Royal Observatory, where they are carefully examined by Mr. Glaisher and an assistant, and, under his direction, tabulated, and reported to the Registrar-general.

The following is the "*heading*" of the monthly meteorological table in which the observations are reduced to mean values, and the hygrometrical results deduced from "*Glaisher's* Tables," —a work no less remarkable for its accuracy than for the immense labour which it saves the calculator in such matters

Besides constantly furnishing the Registrar-general with this mass of information, Mr. Glaisher publishes remarks on the weather during the quarter in the *Philosophical Magazine;* he has also published elaborate memoirs on

"HEADING."

| | | |
|---|---|---|
| Names of Stations and Observers. | | |
| Year 1860. | | Months. |
| Mean Pressure of | | Air and water, or mean reading of the Barometer. |
| | | Water, or elastic force of vapour. |
| Range of reading of the Barometer in the month. | | |
| Temperature of the Air. | Mean. | From dry bulb Thermometer. |
| | | From self-registering Thermometer. |
| | | Adopted. |
| | | Highest. |
| | | Lowest. |
| | | Mean of all the highest. |
| | | Mean of all the lowest. |
| Mean temperature of the Dew Point. | | |
| Wind. | | Strength. |
| | | Direction. |
| Clouds. | | |
| Rain. | | Number of Days. |
| | | Amount Collected. |
| Depth of water Evaporated from a Surface of Water. | | |
| Mean weight of Water in a cubic foot of Air. | | |
| Mean additional weight of Water required to Saturate a cubic foot of Air. | | |
| Mean degree of Humidity. | | |
| Mean weight of a cubic foot of Air. | | |

the same subject, and to a certain extent founded on the same basis in the *Philosophical Transactions*. In addition to this, he gives the public much useful information on the subject in the *Illustrated Almanack*, the *Daily News*, &c. But even this is not all; this indefatigable promoter of meteorological science carefully maps the directions of the wind daily taken at each of the stations, much in the same manner as the specimen which Mr. William Brown, jun. gave in the *Phil. Mag*. for April, 1846. The value of Mr. Glaisher's series of maps will be admitted, if it be considered that they are sketches of facts simultaneously obtained at various normal points throughout the kingdom.

Perhaps it requires no formal proof to show that, however assiduously Mr. Glaisher may labour, it is impossible that he and his ONE assistant at the Royal Observatory can accomplish all that the infant state of meteorological science requires to be done in order that its benefits on the community may have full operation. Work as incessantly as they may, they can hardly carry out to their full extent of general usefulness, all the observed facts which crowd in upon them from the stations abovenamed; much less could they pretend to do so if stations and observers considerably increase, as they probably will do in no long time. Something more, therefore, than mere individual exertion, was wanted properly to manage this accumulating mass of material;—some ruling body was required to co-operate with Mr. Glaisher, and assist him in turning to the best account the large number of valuable facts continually pouring in, and at the same time to be endued with an elastic quality which would enable it to aid in the direction of the efforts of observers, however large their number may become. These points have often been discussed by men who are in the first rank of English science;—still nothing was done.

However, on the 3rd of April last, a meeting of scientific gentlemen took place at Hartwell-house, near Aylesbury, the magnificent seat of John Lee, Esq., LL.D., F.R.S., &c., &c., for the purpose of taking into consideration the present state of our knowledge with respect to meteorology, and of adopting those measures which might seem best for its advancement. Samuel Charles Whitbread, Esq., F.R.A.S., was called to the chair.

The Chairman opened the proceedings by stating that, in his opinion, a necessity existed for the formation of a society, the object of which should be the advancement and extension of meteorological science. Mr. Whitbread advanced various arguments in support of his statement; and after many observations had been made by several gentlemen upon the subject, Dr. Lee read a paper, of which the following is an outline:—

"There is no branch of physical science in which so great a co-operation of so many observers is required as in meteorological researches, in order to trace recorded effects to their causes, and hence to deduce the laws of atmospheric phenomena.

"Causation must be an element in the inquiry; but it is evident that this cannot be, unless an uniform and widely-extended co-operation be established of persons resident in different parts of the country, and that a faithful discussion of their results, for the purpose of ascertaining the laws of a general nature, be also followed up. When this is done, and normal values found, abnormal differences will indicate the amounts and the seats of local disturbances.

"Viewed in this light, it seems to be desirable that an endeavour should first be made to establish a meteorological society, such as will insist upon good and truthful observations from its members; such a society would, it is believed, produce results of the greatest benefit to the public."

The following resolutions were then passed:—

That a society be formed, called "THE BRITISH METEOROLOGICAL SOCIETY."

That the society consist of ordinary and honorary members.

That the annual subscription shall be one pound.

That the year shall end on the 31st of December.

That the meetings of the society shall be on the first Tuesday in each month, at such time and place as may hereafter be agreed upon.

That the officers shall consist of a President, Vice-Presidents, Secretaries, and Treasurer.

The following officers were appointed for the current year:—

*President.*

Samuel Charles Whitbread, Esq., F.R.A.S.

*Treasurer.*

John Lee, Esq., LL.D., F.R.S., F.R.A.S.

*Secretary.*

James Glaisher, Esq., F.R.S., F.R.A.S.

*Council.*

John Drew, Esq., F.R.A.S.
Vincent Fasal, Esq., F.R.A.S.
Rev. S. King, M.A., F.R.A.S.
Rev. Charles Lowndes, M.A., F.R.A.S.
Rev. Joseph B. Reade, M.A., F.R.S.
Edward Joseph Lowe, Esq., F.R.A.S.
William Rutter, Esq., F.R.A.S.

Thus was the nucleus of the society formed at that meeting.

The British Meteorological Society dates its origin from a spot peculiarly favourable to science. Science is there promoted and cherished by all that wealth and pure fondness can do for it. Practical science appears to have adopted the neighbourhood for its favourite abode. Within a circuit of three or four miles there are no less than *four observatories* at which the celestial phenomena are regularly observed and registered! It is scarcely possible that a vagrant star can pass this vicinity without being detected. Dr. Lee's observatory, at Hartwell-house, is one of the first order. The Rev. Mr. Reade has an immense telescope, "pointing to the skies," on his lawn, and a first-rate transit instrument, &c., in his observatory adjoining. His near neighbour, the Rev. Mr. Lowndes, has also a neat observatory fitted up with all the necessary appliances. The nice little observatory, at Aylesbury, is in capital working trim. At each of these observatories there are all the requisite instruments and apparata for observing meteorological phenomena, and they are carefully observed and as scrupulously registered.

To a stranger, fond of scientific pursuits, this district appears to be the fabled land of elysium. Almost every resident seems to be naturally embued with science. It is quite a treat for such a stranger to spend a few hours with Mr. Horton, Dr. Lee's unpretending and communicative assistant at Hartwell-house. To see his regular and methodical mode of observing his barometers and thermometers of various kinds—his rain-gauges, anemometers, &c., and the neat manner in which he keeps all his registers. He learns from Mr. Horton, in the observatory, more manual and practical astronomy than perhaps he has had an opportunity of acquiring before. With Captain Smythe's highly valuable and useful "CŒLESTIAL CYCLE" at his fingers' end, he shows the eager stranger how to find the most interesting object which at the time is visible; or he takes his list of clock stars, shows how to rectify the transit instrument, and, almost at the moment, tells him when he may see the celestial traveller, though hundreds of millions of miles off, enter the field of the instrument to make its progress through it: he orders the admiring gazer to say "NOW" exactly when the beautiful little gem-looking object gets upon each of the five wires. He then explains how the mean is taken—how the "Nautical Almanack" is used in the process,—how the mean is corrected,—how nearly it agrees with the number corresponding to the middle wire—and the use of the result in showing how much the astronomical clock in the observatory is too fast or too slow. Such is the place which "The British Meteorological Society" claims for its birth spot, and such are the scientific pursuits of the residents. We trust the labours of the Society in the cause of science will confer a credit even on the place of its nativity and its foster fathers.

The above list of officers was only the commencement;—it was incomplete. The Society has since met at 5, College, Doctors' Commons, when a large number of members were admitted, and the following list of officers elected for the year:—

*President.*

Samuel Charles Whitbread, Esq., F.R.A.S.

*Vice Presidents.*

Lord Robert Grosvenor, M.P.
Hastings Russell, Esq., M.P.
General Sir T. M. Brisbane, K.C.B., F.R.S.
Luke Howard, Esq., F.R.S.

*Treasurer.*

John Lee, Esq., LL.D., F.R.S., F.R.A.S.

*Secretary.*

James Glaisher, Esq., F.R.S., F.R.A.S.

*Council.*

John Drew, Esq., F.R.A.S.
Vincent Fasal, Esq., F.R.A.S.
Rev. Samuel King, M.A., F.R.A.S.
Edward Joseph Lowe, Esq., F.R.A.S.
Rev. Charles Lowndes, M.A., F.R.A.S.
Rev. Joseph B. Reade, M.A., F.R.S.
William Rutter, Esq., F.R.A.S.
Thomas Shapter, M.D.
Capt. F. Blackwood, R.N., F.R.A.S.
Rev. Temple Chevallier, M.A., F.R.A.S.
Professor Stevelling, LL.D.
George Leach, Esq., F.M.S.

We have devoted considerable space to this subject, because we consider it an interesting one, and because we think the founders and promoters of the Society have set about it *con amore*—as the true friends of science. The moderate subscription is a general invitation for cultivators of science of *all grades* to become members. The composition of the list of officers deserves notice: they are all ardent labourers in practical physical science, from the president to the end of the list. We believe that nearly half of the gentlemen have observatories for astronomical purposes in full operation; and every one of them is a laborious cultivator of meteorological science. The venerable Howard has earned European fame by his meteorological performances. The arduous official duties of the indefatigable secretary have not prevented him from giving the most valuable information in numerous instances with regard to instruments and other practical matters.

Quetelet, in his twenty-ninth letter on the Theory of Probabilities, says—"Among the variable facts which we observe on the surface of the globe, the most remarkable are certainly those which obey the laws of periodicity. The phenomena, for instance, which fall under the influence of time are greatly modified by the diurnal and annual periods. These phenomena, to this day, have been considered separately, and have found places in the different branches of science, according to the caprice of those who have observed them. It may, however, be easily conceived that this species of allotment must arrest the progress of science, and prevent us from discovering the general connections of periodical phenomena one with another. Thus statistical science has examined with a scrupulous attention the influence of the seasons on mortality, on crime, on mental alienation, on suicide, on commerce, &c.: it has borrowed from meteorology the indications of the temperature and variations of the atmosphere, and required from medicine the results of its observations on the nature and severity of maladies in their relation to the different months of the year. It receives from the natural sciences, and from agriculture, information upon a host of interesting facts; but these facts are almost always collected and classed in separate tables: no one, as far as I know, has thought of observing them simultaneously."

It was the idea of filling up this gap in science, the celebrated author says, which induced him to bring the subject before the British Association at Plymouth, in a memoir to which we have already adverted.

We have before stated that the results of the meteorological observations daily made at all the before-named stations are constantly sent to the registrar-general's office. We happen to know that many important investigations are now in progress in that office. Several diagrams of diseases have been formed in connection with the results of recent meteorological investigations. The fall of rain in different parts is now forming an important subject of investigation, with a view to the better supply of large towns with water.

The knowledge of a disease is half its cure, and the knowledge of causes is some way towards counteracting their effects. This truism was never more apparent than it was in the late visitation of the cholera; even that appalling pestilence was, in many cases, deprived of its horrors when the causes that before had added intensity to its deadliness had been removed or counteracted.

We cannot prevent the thunder-cloud from forming, but we can direct its discharge so that it may pass harmlessly away.

We shall not be able to hinder storms from gathering, but when their laws shall be better understood, we shall be able to withdraw our ships from their tracks, and in this manner avoid their disastrous effects. The barometer, by-and-bye, for this purpose, will be as carefully observed by the skilful seaman

as the compass or the quadrant. We believe it was Capt. W. H. Smythe, then in command of a ship in a distant part of the world, who observed a sudden and remarkable change in the barometer. Although the weather was fine, he knew the truthful indication of the instrument, and immediately ordered all hands to prepare for a coming storm. The men were suspicious; but they had barely time to carry the order into operation before a terrific storm commenced, which, had not their scientific commander promptly acted on the certain warnings of the barometer, would probably have left neither ship nor crew to relate the ruin which it had wrought. In such an article as this, it is impossible to point out all the advantages that must accrue to the astronomer, the agriculturist, the mariner, the physician, and to philosophers of every class, by the careful study of the laws of meteorological science, and by a general circulation of the knowledge of these sciences. Such advantages, we think, may confidently be anticipated from the British Meteorological Society. We heartily wish it success; and we advise our readers of every class to afford it all the assistance they can.

## THE EMBANKMENT OF THE THAMES.—MR. PAGE'S PLAN WITH SIR SAMUEL BENTHAM'S IMPROVEMENTS.

Sir,—The great interest at present taken in sanatory questions, including the means of getting rid of sewage, and the noisome exhalations from it on muddy shores, seems to have awakened a new attention to the embankment of the Thames; and it has lately been proposed again that quay walls should be erected in a curvilinear line from Westminster Bridge towards the city.* This was the plan proposed by Mr. Page to the Commissioners for the Improvement of the Metropolis, and to which, subject to modifications and improvements, they gave the preference. Various objections to this plan had been, however, started, but for which no remedy had been proposed; the principal of these objections were the great cost of the embankment wall—the throwing the expense of it upon the whole of the inhabitants of the metropolis by an increased duty on coals, although the only persons likely to profit by the proposed work would be the comparatively few who would traverse the new road on the embankment—and the diminution which the embankment would occasion in the floating room for coals, a considerable store of which commodity is habitually kept in barges.

It seemed, however, that these objections might be obviated by means which Sir Samuel Bentham had devised. It had happened that in the year 1801, the Select Committee for the Improvement of the Port of London requested his opinion,* on which occasion his attention had been much directed to the subject of the embankment of the Thames; afterwards in devising a new naval arsenal at Sheerness, he had to consider whether the cost of a great length of quay-wall might not be compensated for by an appropriation of the structure to some collateral use; many of his ideas seeming applicable to the embankment of the Thames, particularly as obviating the above-mentioned objections to Mr. Page's plan, a selection was made from Sir Samuel's papers, and submitted to the Commissioners for the improvement of the metropolis: the following are copies of the letter to the Commissioners, and of the suggestions which accompanied it.

I am, Sir, &c.,

M. S. B.

April 16, 1844.

"(Copy.)

"My Lords and Gentlemen,

"In requesting permission to submit the accompanying suggestions for the improvement of the Thames, it seems proper to say that they are compiled from the papers of the late Sir Samuel Bentham, K.S.G., who held successively the offices of Inspector General of Naval Works, and of a Commissioner of the Navy, with the distinct duty of Civil Architect and Engineer.

"I have the honour to be,

"My Lords and Gentlemen,

"Your most obedient servant,

"M. S. B."

"To the Commissioners for the

"Improvement of the Metropolis.

"Mr. Page's plan for the embankment of the Thames having, as I understand, been sanctioned by the Commission for the Improvement of the Metropolis, subject to such modifications and improvements as might appear advisable, the following modifications

* See *Mechanics' Magazine*, No. 1357, page 126.

are proposed with a view to compensate in a great measure for the expense of the work, insomuch (it is believed) as to do away the need for any new duty on coals; as also to afford an equivalent to the trade of the river for the accommodation necessarily obstructed by the site of the embankment.

"It is suggested that the embankment should be raised some feet higher than is proposed by Mr. Page, obtaining thereby beneath the terraced roadway height sufficient for the purposes below stated, yet not to so great a height as to intercept a view of the river from the houses looking towards it.

"That the embankment, instead of being solid should be a *hollow* structure; the walls perpendicular, as in Mr. Page's plan on both sides of the embankment. That between these walls and the bottom should be formed either of reversed arches, or of concrete carried down to the London clay.* That the structure should be for strength, divided by a longitudinal wall, and transversely separated into convenient portions, the whole arched over at about high-water mark. Two ranges of storecellars would thus be formed on the basement of the embankment.

"That above these storecellars a double range of storehouses should be erected, either arched over, or rather roofed with a platform framed principally of iron, and at the height that might be determined on for the foundation of the roadway.

"As the expense of construction would be thus compensated for by rent of the storehouses and cellars, and storehouse room be provided in lieu of the present floating storehouses in barges, it might be desirable to encrease the width of embankment from 40 feet,† to 50 feet or even 60 feet.

"That the communication between this terraced roadway and such streets now leading to the Thames as might be determined on, should be formed by means of transverse roads, either in the way of bridges or on a structure of warehouses in the manner of the terrace embankment; sluices being formed in the basement where expedient.

"The upper range of storehouses would be equal in every respect to the best of any by the river side, and by a judicious architectural arrangement of the windows and apertures for receiving stores, the face towards the river might be rendered highly ornamental.

"It would seem desirable that the waterway between Scotland Yard and Westminster Bridge, with the exception of the low-terraced embankment proposed, should be left as a reservoir for water, ready for use, to scour the docks below. This need not prevent its being rendered ornamental. But should it be thought by private persons worth the expense, any part of it might be arched over, as was done in Portsmouth Dockyard, to obtain space for the wood mills, and for the general use of the Dockyard*; thus foundations might be formed for islands or low buildings, in addition to the gardens of the contiguous houses.

"It is calculated that the rent of the above-mentioned storehouses and cellars, even at a moderate rate, considering situation and convenience, would at least pay a fair rate of interest on the capital sunk for their construction, including the embankment walls up to the foundation of the road above. The total thickness of wall, with the interior longitudinal one, need not be greater than what would be necessary for the simple embankment†. The weight of stores within the storehouses would hardly ever equal that of the gravel intended to fill in a solid embankment.

"Various minor details are contained in the papers from which the above suggestions are extracted, such as—A light railroad carried on the north side of, and on a level with, the floor of the upper range of storehouses, so that stores might easily be conveyed from them to appropriate apparatus for hoisting stores to the level of streets communicating with Whitehall, the Strand, and Fleet-street. This railroad might also serve, by night especially, as the walk of policemen, overlooking and guarding all the craft and wharfs below. Swing railways communicating at pleasure with the wharfs. A timber seasoning store on the principle of that invented, and long in use, by the late Wm. Strutt, Esq., of Derby, where deals and timber of small scantling were effectually seasoned in a few days. Air pipes brought from any or all of the storecellars and storehouses to some fire, so as to dry and ventilate them perfectly. Details for the comfort and convenience of the public, such for example, as for the protection of pedestrians on the terrace, an open iron barrier between the foot and carriage ways; which rail might also contribute to the strength of the platform should that be adopted in preference

* For the superior stability and economy of foundations laid immediately on stiff clay, Smeaton's pier at Ramsgate may afford an example, and more particularly various of the great works in Portsmouth Dockyard, and the Thames Tunnel.

† The width proposed by Mr. Page.

* See Naval Papers, No. 8, page 74.

† Dr. Hutton in his observations on the late Mr. Rennie's plan for the Swilly Bridge, gave it as his opinion that "a hollow tubular body is *much stronger* than a solid one of the same quantity of materials."

to arches. Covered retreats at distant intervals to afford shelter for foot passengers. Foot passages under the carriage road for crossing under it, so as to afford, without danger, access to the streets connecting the terrace with the town, &c. Other details in regard to machinery for levelling, scouring, and keeping clean the bed of the docks and river, such as—affixed to a dredging engine, new apparatus somewhat in the nature of large rakes and hoes for loosening up mud, so that it might be carried away by sluices or the tide—means of diminishing the expense of under waterworks, especially of that for constructing walls, &c.

## WILKINSON'S PATENT FOR GENERATING STEAM POWER IN CONJUNCTION WITH RAREFIED AIR.

(From the *Railway Record.*)

At a time when the greatest efforts are being made to economise the working expenses of railways in this country—efforts invoked by that ancient parent of invention, necessity,—when the labours of Messrs. Adams, England, Barlow, and a host of other honourable workers in the field of locomotive improvement are being brought to bear on the reduction of the terrific expenditure of our railway lines,—and the attention of the Legislature is, seriously we trust, given to the amelioration of some of the most oppressive forms in which taxation presses on the receipts of traffic, we have much pleasure in bringing before the notice of the public an improvement in the generation of steam, which has been patented by Mr. Wilkinson, and which promises to effect one of the most important advances in the economy of steam which has ever yet come under our observation. Hitherto Mr. Wilkinson has confined his experiments, as we understand, to stationary engines, but is actively engaged at this moment in adapting this principle to the locomotive engine; and if the same success attend his labours in this department as have accompanied his endeavours on the fixed engine, the practical results assume the most encouraging aspect.

The principle consists in the injection of a stream of air, heated to the high temperature of from 600 to 800 degrees into the steam in the boiler, by which means the temperature, and consequently the expansive force of the steam, is greatly increased. This object is effected as follows:—An iron pipe, bent into a serpentine form, so as to present a great extent of surface in a given area, is placed over the glowing part of the fire; one end is inserted somewhere above the surface of the water in the boiler, and the other end is connected with an injecting pump. The whole capacity of the pipe is much greater than the volume of compressed air which it receives at each stroke of the piston, so that the air does not enter the boiler until it has acquired the full heat, or nearly so, of the red-hot pipe through which it passes.

The pressure of the air in the pipe, strictly speaking, exceeds that of the steam in the boiler; for it is an excess of pressure that overcomes the resistance of steam, and forces a passage for the air; but with a communication between the two vessels by an aperture the whole size of the pipe, we may, practically, consider the pressure of air in the pipe equal to that of the steam in the boiler.

At every stroke of the piston, the same quantity of cold air is injected, at whatever pressure the engine may be working: that part of the air which was next to the pump is forced further on to a hotter place, and the air, which previously occupied that hotter place, is forced on to a still hotter one, and so on, till the furthermost and hottest of all is discharged into the steam in the boiler. But the air continues to flow into the boiler after the action of the pump has ceased; for every part of the contents of the pipe having advanced to a place of higher temperature, the radiation from the sides of the pipe instantly raises the temperature of the air, and causes it to expand, and continue to discharge its hottest parts into the boiler, so long as by repeated injections the air is kept at a lower temperature than that of the pipe.

The result of experiments on a fixed engine show that the application of the heated air caused a reduction in the quantity of coals consumed of from 25 to 30 per cent.; and this was continued for several weeks, the engine, of course, working at its usual pressure.

The early experiments were on a small engine, working in the factory of Mr. Burman, Cumberland-street, Curtain-road, and later trials have been made, all leading, as we are assured by Mr. Wilkinson, to the same satisfactory conclusion.

We shall await with anxiety the application of the principle to the locomotive, and shall not fail to record this marvellous step in the progress of railway economy.

[The readers of the *Mech. Mag.* already know something of Mr. Wilkinson's improvements. They were fully treated of in a paper from an intelligent contributor (R. B.) in our 44th vol., p. 482. Ed. M. M.]

## PRINCE ALBERT'S SEWAGE FILTER TANK.*

Sir,—The benefits derivable from the *Mechanics' Magazine* are perhaps of greater amount when it indicates what are still desiderata, then even when it affords information of that which has been already effected; in this view of its usefulness the mechanical requirements relative to a plan in contemplation respecting the sewage of large towns, seems particularly worthy of being laid before your readers.

Professor Way has made the important discovery, that finely divided clay abstracts colouring matter, smell, and impurities from the foulest and most fetid water. His Royal Highness Prince Albert has proposed the turning this discovery to practical use, for the purification of the water of the sewage of towns, and for the application of the manuring matter contained in it to the purposes of agriculture. There cannot be a doubt but that, as to principle, His Royal Highness's plan would be perfectly efficacious.

His Royal Highness has proposed that the sewage should be received in the bottom of a tank, having a false bottom raised something above the real one; that upon that false bottom clay should be laid, through which the fluid of the sewage would be filtered by ascension, leaving the more solid impurities below the false bottom.

There appears to be, however, some mechanical difficulty as to that false bottom, seeing the immense quantity of sewage emitted by a London sewer (for example), requiring consequently a vast false bottom, with sufficient openings in it to allow the ascension of water through them as fast as it enters the tank from the sewer, and yet those apertures so small as to retain the strata of clay above them.

His Royal Highness suggests the construction of tanks in pairs, so that they might alternately receive the sewage, and alternately be cleared out. Such tanks there can be no doubt might conveniently be constructed in different parts of the muddy shores of the Thames; and the water, having been purified by percolation through the clay, might without detriment to the river run into it; the manuring matter might be carried away in barges with little annoyance from its smell, since the only part of it having any would be the solid matter under the false bottom.

The points for the consideration of your readers relate to the false bottom principally.

Of what material, form, and strength, should the false bottom be made?

How should it be supported?

Should the whole of it be moveable, or only portions of it sufficient in size to allow the solid matter below to be cleared out?

Can perforations in the false bottom be made small enough to retain clay above them; or must some porous matter intervene between the perforations and the clay?

Supposing cast iron to be the material used for false bottoms, is it known how soon it would be converted into plumbago if, as has been supposed, mud and the emanations from it produce that effect?

What form of scoop and kind of apparatus would best clear out and deliver the manuring matter both from the upper and the under parts of the tanks?

What the most appropriate apparatus for charging the tank with clay?

What provision should be made for delivering immediately into the river on occasion of extraordinary heavy rains the enormous quantity of water with which the sewers are then charged?

It will hardly fail to be observed in regard to His Royal Highness's plan, that the adoption of it for the metropolis would be economical, though the value of the manure should prove but a bare equivalent to the cost of obtaining it, since the existing sewers would continue serviceable. On sanitory considerations there would be no objection to the running of water that had been purified into the Thames, the only practicable outlet, it seems to be thought, for the water that falls in and about the metropolis in rain, besides the immense and continually increasing quantity to be got rid of, after its use for domestic purposes.

M. S. B.

* "Prince Albert has recently sent an exceedingly able and valuable paper to the Royal Agricultural Society of England on "The Sewage of Towns," in which His Royal Highness developes a plan for filtering the sewers at convenient intervals, thus accumulating in convenient tanks a rich and valuable manure, and liberating the water from all mechanical admixture of impurity."—*Evening Paper*.

DISCUSSION ON RAILWAY AXLES, AND ON THE STRUCTURAL CHANGES WHICH IRON IS SUPPOSED TO UNDERGO FROM VIBRATION AND CONCUSSION.

(Continued from page 395.)

Mr. McConnell thought it was so. Whenever iron was subjected to a jar, the fracture was square across, and it seemed as if the whole structure of the iron became brittle like glass. For in the instance he had mentioned of the chain sling, the iron was so brittle that a small tap of a hammer would have broken it; hence, it must be obvious that whatever might be said as to the relative strength of fibrous and crystalline iron, there was a striking difference between tough and brittle. He spoke then guardedly, because, from what he had seen of the appearance of iron under the microscope, he was induced to think that the word fibrous, which they had hitherto applied to the structure of iron, was a misnomer, if applied in the ordinary English acceptation of the term. That, however, an alteration did take place in the quality or condition of iron was manifest, from a great abundance of evidence; and he thought it would be a decided improvement if they adopted some other word which would express the same quality or condition of iron in its tough state: yet it was clear that a change did take place, making that which was originally tough quite brittle. The effect on a railway axle had been already explained by the instance of a string in vibration. When the axle was at work a node was created at the back of the wheel at each end, and it would be found that although it broke off short at the back of the wheel, yet in the centre it remained quite tough, as if the vibratory wave had passed freely through it. He should be glad to see the matter further investigated, as the subject was one of great importance, and at some future meeting he hoped to be prepared with some further information on the subject.

The Chairman remarked, that the question of comparative strength was one of great importance; but it must be borne in mind that there was great difference between the two strains of pressure and percussion; and he doubted whether highly crystalline iron was much weaker than iron which was highly fibrous, if care were only taken of the situation in which it was employed. In the course of the building of the Britannia Tubular Bridge, his attention was called by his assistant, Mr. Clark, to a series of bad plates which had been delivered. Instead of being fibrous boiler plates, they were short grained and brittle; and this, in so large a structure, was regarded as a serious objection to them; accordingly it was decided to remove them from the bottom of the bridge to the top, as in that situation they would be subject to compression instead of tension. He (the Chairman) thought it right to test the tensile strength of those plates, and accordingly they had slips cut from the respective plates, and very much to their surprise the crystalline plates were much the strongest; for the average strength of the fibrous plates was 18 tons to the square inch, and in a great many instances it ranged as low as 16 tons, whilst the crystalline plates averaged a strength of 21 tons, though they could hardly punch the holes in them, which was a good test as to the quality of the plates. Hence they came to the conclusion, that what is called crystalline iron is capable of a greater steady tensile strain, and that it does not appear less suitable than fibrous iron for an erection of the character in which they were engaged; and this certainly agreed with the notion of the crystallized facets being bundles of small fibres cut across at one plane. At the same time he thought it would have been objectionable to have put the crystalline plates at the bottom of the tube, because the trains were producing continual vibration; and the two strains—the one under vibration, and the other under steady weight—were very different in their character, and in their effect on iron. The mode of testing the plates at the bridge was by a very direct means, and therefore the results might be relied on with great confidence. They were tested by actual weights suspended direct from the plates themselves, and the strain was not put on by any machine, such as the hydraulic press, or by levers, where the fulcrum was liable to alter a little, causing a material difference in the leverage; and there was a considerable amount of friction to interfere with the correct result. This would account in some measure for the great discrepancy which prevailed in the results of former experiments with reference to the strength of iron during the last twenty years. Some had thought that the ultimate strength was 24 tons per square inch, but he was satisfied that in no well-conducted experiment would it be found to exceed 21 tons; and he felt that they could not safely rely upon a greater strength than 16 or 18 tons for practical purposes.

Mr. Slate inquired whether, when the Chairman spoke of 16 or 18 tons being the ultimate limit of elasticity, he meant would it fracture at that point.

The Chairman believed that fracture took place in every instance.

Mr. Slate said, he had, with some others, made some experiments on the strength of iron bars, and had minutely tested their elastic power. The result he had arrived at was, that after the elastic point was once

passed, time became a most important element in the fracture, and the breaking point would depend upon the rapidity with which the weight was put on. In some bars of the best quality of iron, 9 inches by 1 inch, the ultimate strength was 17¼ tons per inch, but the permanent stretching began at about 8 tons per inch, and if that strain had been long enough continued, he considered the bar would have broken with it.

*(To be continued.)*

*Philips's Annihilator.*—We have received a letter from the Solicitor of the Fire Annihilator Company, complaining of the article which appeared in this Journal of the 18th of May, signed "Anti-Combustible," and requiring to be furnished with the name of the author. We have instituted an inquiry into the correctness of the statements contained in that article, and shall be guided by the result; but, in the mean time, it is but right that we should immediately make known that the Company denounce them as "false," and therefore most unfairly "prejudicial to their interests."

SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 30TH, 1850.

CHARLES BARLOW, Chancery-lane, London. *For improvements in the manufacture of a certain pigment.* (A communication.) Patent dated November 29, 1849.

*Claims.*—1. The application of a deoxydizing gas containing carbon to the manufacture of zinc white.

2. A mode of converting impure oxide of zinc into pure zinc white.

3. The use of receivers containing moveable screens in such manufacture.

4. A mode of subliming the arsenic which is contained in the zinc by a peculiar method of heating it.

FRANK CLARK HILLS, Deptford, Kent, manufacturing chemist. *For an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same.* Patent dated November 24, 1849.

1. The peat-compressing apparatus of Mr. Hills consists of two troughs, with gratings for bottoms. Above each of these gratings there is laid a quantity of coarse gravel, or other filtering medium, of a size sufficiently large not to pass through the openings, and above that successive layers of finer gravel, and, last of all, one of sharp-pointed sand. A sheet of perforated metal is placed above the last layer of sand, and supported on cross bars, to prevent it from giving way under pressure by the subsidence of the sand and other filtering media. The upper part of the trough is furnished with a cover, bolted to the edges, or kept down by a weighted lever, and the filtering medium is placed in the trough up to a certain point only, in order that there may be a space between the cover and the perforated plate, in which a plunger travels to and fro. The size of the outlet of the trough is regulated by means of two adjustable plates or rollers, for the purpose of regulating the pressure to which the peat is to be subjected. The open ends of the two troughs are placed opposite one another, and their respective plungers are attached to either side of a slotted plate, in which works a crank shaft, driven from a steam-engine or other prime mover, so that at each revolution one of the plungers will be driven forward and the other drawn back. Each trough is provided with a hopper, filled with peat. When the plungers are drawn back, a supply of peat falls down, which at the next stroke is propelled towards the contracted outlet, and so on at each forward stroke of the plunger, until the whole of the moisture is driven through the perforated plate and filtering media, and the solid matters are expelled from between the adjustable plates or rollers in a dry and compressed state.

2. The improvements in "purifying" gas consists in depriving it of its sulphureted hydrogen, cyanogen, and ammonia by passing it through the subsulphates of iron, oxychloride or the hydrated or precipitated oxides of iron, either alone or combined with sulphate of lime, sulphate or muriate of magnesia, baryta, strontia, soda or potash, and mixed with sawdust, breeze or other absorbent material, which will allow of the passage of gas through it. The hydrogen will combine with the oxygen, and form water, and precipitate the sulphur; while the ammonia will partially combine with the water, and the rest be absorbed. When the absorbing materials become inert, they are revivified by passing a current of atmospheric air through them, which drives off the volatile gases, and revivifies them. The passage of air is created by connecting, for the time being, the purifyer to a chimney or other exhaust; and the rest of the ammonia is condensed by means of suitable apparatus placed in the pipes leading to the chimney.

3. Mr. Hills proposed to apply the waste heat of distilling retorts to the heating of what he terms "warming retorts," in which the coal is placed prior to its distillation, in order to economise heat in the latter process.

4. To obtain an equable and intermittent supply of the necessary water to gas scrubbers, it is proposed to place above the purifying vessel a reservoir to receive the water from the source of supply. This vessel is

made with a long opening at bottom, fitted with a slide valve, on the spindle of which there is a float. The end of the spindle is attached to a tumbling lever. As the water flows in, the float will raise the one end of the tumbling lever to a certain point, when the latter will suddenly fall over to the other side, and jerk open the valve, whereby a sudden but equable supply of water will be admitted to the purifyer. When the outflow of water has brought the float down to a certain point, the tumbling lever will fall and suddenly close the valve.

5. The "improvements in obtaining certain substances applicable to purifying gas" consists in combining the chemical substance, as enumerated under the second head of the specification, with sawdust, breeze, &c., and exposing them to the atmosphere for the purpose of absorbing the oxygen.

Joseph Pierre Gillard, Paris, gentleman. *For certain improvements in the production of heat and light in general.* Patent dated November 22, 1849.

*Claims.*—1. The production of hydrogen gas by decomposing water in furnaces and retorts serving to distil coal.

2. A process for producing hydrogen gas and a small quantity of oxide of iron.

3. Illuminating by means of electro-magnets put in motion by any mechanical power.

4. Producing hydrogen and oxygen by means of magnets put in motion simultaneously by any suitable power, the two gases being collected in separate vessels.

5. Rendering platina and other unalterable and inoxidizable metals illuminating by the combustion of hydrogen and oxygen.

6. Rendering platina and other non-oxidizable metals more or less illuminating by means of hydrogen, or of hydrogen and oxygen, and also of oxygen and hydrogen combined.

7. Illuminating by heating platina and other metals to a luminous white heat by means of oxygen, burnt either alone or combined with hydrogen.

8. Deoxidizing ores by means of hydrogen, or of hydrogen and oxide of carbon, or hydrogen and oxygen combined.

9. A mode of producing pig iron and purifying metals.

Francois Justin Duburguet, Cahors, France. *For certain improvements in hydro-pneumatic engines.* Patent dated November 22, 1849.

This invention relates to the construction of forcing and lifting pumps, and other hydro-pneumatic engines, and embraces the application of the syphon for raising water by the rarefication and pressure of the atmosphere.

*Claims.*—1. Raising water by means of the rarefication and pressure of the air, and its application as a motive power to pumps and other hydro-pneumatic engines.

2. Raising water by means of the syphon from an inferior into a superior basin, and its application as a motive power.

3. A peculiar construction of blast furnace, in which the blast is created by the application of hydrostatic pressure.

George Calloway, of Putney, Surrey, and Robert Allee Purkis, of the same place, engineer. *For certain improvements in propelling ships and other vessels, also in apparatus for ploughing.* Patent dated November 24, 1849.

The patentees describe and claim—

1. Placing two centrifugal pumps in the stern of the vessel, one on each side of the keel, which are constructed like the ordinary blowing fan, and take in water through the centres of the fans from the bows of the vessel, and expel it in two columns at the stern. The outflow pipes are provided with moveable nozzles, which are made to incline in any required direction, to regulate the steering of the vessel, by means of suitable connecting gear leading from the barrel of the wheel on deck.

2. A steam plough, which consists of a triangular frame, having a ratchet wheel at each angle, round which are passed a number of pitch chains fitted on the outside with ploughshares. The frame is supported in a carriage, with its base parallel to the surface of the ground. The locomotive is attached at right angles to the centre of the frame, and communicates rotary motion to one of the ratchet wheels, whereby the ploughs will successively enter and leave the ground after having turned it over.

Henry Lamplough, Snowhill, consulting chemist. *For a new mode of supplying pure water to cities and towns.* Patent dated November 24, 1849.

Mr. Lamplough proposes to convey water through pipes laid near the surface, and to lift it over the irregularities of the ground by means of syphons. When the water has to rise above thirty feet, he employs some mechanical power to effect this.

*Claim.*—Combining a series of pipes, reservoirs, and syphons, for conducting water to towns.

Charles Cooper, Southampton-buildings, Chancery-lane. *For certain improvements in piling, fagotting, and forging iron for plates, bars, shafts, axles, tyres, cannons, anchors, and other similar purposes.* Patent dated November 24, 1849.

These improvements consist—

1. In making piles and fagots of bars having the section of a trapezium.

2. In applying these piles to making various articles of manufacture.

3. Making mortars of wrought iron, by forging them out of piles composed of trapezoidical bars, by means of hammers or dies.

4. Manufacturing shafts by placing curvilineal bars round a rod, in order that the lines of junction may be curvilineal, and not in a line radiating from the centre.

5. Making hollow shafts by coiling trapezoidical bars round a cast iron rod, which is afterwards to be melted out.

6. Making cannons of trapezoidical bars twisted in a helical direction round a core.

7. A mode of casting trunnions to cannons so made.

8. Making wheels out of helical coils of trapezoidical bars.

9. Rolling the tyres of wheels out of trapezoidical bars coiled up helically.

AMBROISE ADOR, Paris, France, engineer. *For improvements in producing light.* Patent dated November 24, 1849.

Gas is supplied from the top of the apartment into a vessel which contains some hydrocarbon. A pipe which opens at top, above the level of the liquid, passes down through it, and terminates in a second spherical vessel placed above the glass chimney. From the latter vessel two pipes descend to the burner. When the burner is lighted it heats the lower spherical vessel, which, being of metal, transmits the heat to the second spherical vessel, and vapourises the hydrocarbon contained therein. The gas entering this upper vessel mingles with the vapour of the hydrocarbon, and descends with it into the second vessel, where the two are heated before passing to the burner.

*Claim.*—Combining apparatus for vapourising hydrocarbon with, and intermediate to, a gas burner, and the tube which supplies it with gas.

JOSEPH BARRANS, St. Paul's, Deptford, Kent, engineer. *For improvements in axles and axle-boxes of locomotive engines and other railway carriages.* Patent dated November 24, 1849.

*Claims.*—1. Arranging axletrees and axletree-boxes of railway engines and railway carriages with adjustable apparatus to make up for wear, to prevent prejudicial endway motion. [This apparatus consists of a wedge placed between the end of the axletree and the side of the box, which is forced up between them, as the surface wears away by a screw. The rubbing surfaces are faced with steel, and supplied with some lubricating substance.]

2. A means of preventing grit getting into axletree-boxes [by placing a collar round the axletree, and over that a casting, which is bolted to the box].

3. Arranging axletree-boxes with a receptacle to catch the grease.

WILLIAM GARNETT TAYLOR, of Burton-hall, Westmoreland, gentleman. *For improvements in lint and in linting machines.* Patent dated November 24, 1849.

*Claims.*—1. An improved linting machine in the general arrangement, combination, and peculiar adaptation of parts of which the same consists; that is to say, in so far as regards the composition and construction of the bed; the regulation of the movements of the knife by means of a revolving shaft, tappet-wheels, springs, and screws; a carded feed-roller, and pressing roller; and the regulation of the movements of the cloth by means of endless screws, worm-wheels, and presser-bar.

2. A modification of the preceding machine, in so far as regards a combined to-and-fro, and rising and falling motion, given to the knife, and the combination of parts on which such motion depends.

3. A second linting machine, in so far as regards the adaptation of revolving cutters or knives, to the linting or raising of a pile on linen and other fabrics.

4. A third machine, in so far as regards a combination of rotating knives or cutters, with a revolving bed for linting purposes.

5. The employment of combs instead of knives for linting purposes.

6. The employment in linting machines of knives made to slide by means of cams.

7. A fourth machine, so far as regards a reciprocating bed, and the combination therewith of the parts on which the reciprocating motion of such bed depends.

8. The employment in linting machines of elastic beds composed partly or wholly of vulcanised caoutchouc, or metallo-thionized gutta percha.

9. The employment in linting machines generally, of any one, two, or more of the parts before specifically claimed, however such machines may in other respects be constructed.

JAMES GEORGE NEWEY and JAMES NEWMAN, BIRMINGHAM. *For improvements in the manufacture of buttons, studs, and other dress-fastenings and ornaments.* Patent dated November 28, 1849.

This invention consists—

1. In the manufacture of ornamental buttons and studs, by superimposing a perforated sheet of metal upon another plain sheet, to which there has been previously affixed a number (corresponding to the perforations in the first plate) of projections, composed of coloured glass, or other suitable vitrified substance, so as to produce the appearance of precious stones set in metal. The two metal plates are united by bending the ends of the perforated plate over the plain one, to form the shank. Or, two pieces of different coloured glass are stamped out and united, after which the surface of

one is ground down to allow of that of the other being seen.

2. In rolling the sheets of metal used in the manufacture of these kinds of buttons with parts of greater thickness than the rest, to form the shanks, by employing for that purpose rollers with indentations on their peripheries.

3. In attaching buttons to washing waistcoats by means of a cord, to which short metal tubes are attached at certain regular distances apart.

The claims embrace the different modes of manufacturing buttons or studs and dress fastenings, as described in the specification.

FRANCIS TONGUE RUFFORD, Prescott House, Worcester, fire-brick manufacturer; ISAAC MARSON, Cradley, Worcester, potter; and JOHN FINCH, Pickard-street, City-road, Middlesex, manufacturer. *For improvements in the manufacture of baths and wash-tubs, or wash vessels.* Patent dated November 24, 1849.

The patentees describe and claim,

1. The manufacture of baths in one piece by the following means: Five parts of fire-clay are ground up with one part of potsherds, and the whole tempered and prepared as usual. The finer portions are separated from the coarser ones, and both made into rolls. The fine clay is moulded on a board of the size of the bottom of the intended bath, which is fitted with edges to obtain the required depth, and after that the coarser clay rolls are laid on. After this the bottom is turned over, the board removed, and a plug, covered on the outside with wet calico, or other fabric, and of a size of the body of the bath, placed on the surface lately occupied by the bottom board. The walls of the bath are built up round the plug—the fine inside and the coarse clay outside. In case of need, the walls are supported by boards, and when the whole is completed it is left to dry and stiffen. After which, the inside surface is dressed with knives and sponged, as usual, and coated with potter's body prepared by grinding and fritting.

50 parts China clay.
30 do. bone earth.
15 parts carret.
5 do. raw borax.

The patentees then take,

50 parts of this frit.
35 do. China clay.
10 do. blue clay.
5 do. flint.

The last compound is mixed up, and reduced to a powder; a portion to the size of cartridge powder, and the rest to as impalpable a powder as possible. The coarse body is well rubbed into the interior surface of the bath, and after that the finer body is applied, the surface being dressed as usual. The bath in this state is placed in a kiln, which is gradually heated until it is well burned, and takes the appearance of "biscuit." The kiln is then cooled down, and the bath removed to be glazed, which may be effected by dipping the bath in a glaze—taking care to prevent the glaze from adhering to the outside by oiling it. Or the glaze may be brushed over the bath by first coating it with a compound of linseed oil and turpentine, over which, when dried, the glaze is to be laid. The glaze which the patentees use by preference is composed of

5 lbs. calcined borax.
20 lbs. Cornwall stone.
2 lbs. 8 ozs. whiting.
3 lbs. 8 ozs. chalk.
33 lbs. white lead.
13 lbs. red do.
3 lbs. burned flint.

When the interior of the bath is coated with the glaze it is placed in the kiln, which is gradually raised to the temperature at which the glaze vitrifies, which is ascertained by test pieces in the usual manner. When this occurs, the kiln is cooled down, and the bath withdrawn to be ready for use.

2. The mode of manufacturing wash-tubs and wash vessels is the same as that employed in making baths in one piece, and last described.

3. It is proposed to make plunging and other baths of bricks, blocks, or slabs, which are made of fire-clay, and have the sides intended to come in contact with the water coated with potter's body; and glazed in the same way as the baths just mentioned. When the blocks or slabs used are of larger area and less thickness than the ordinary bricks, they are to be made with projections at the back to admit of their being "bonded" with the common bricks in the course of building.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

William Radley, chemical engineer, and Frederic Meyer, oil merchant, both of Lambeth, Surrey, for improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies, in the manufacture and application of them, and of their components and subsidiary products, together with the apparatus to be employed therein to new and other useful purposes. May 25; six months.

Edwin Pettitt, of Birmingham, civil engineer, for improvements in the manufacture of glass, in the method of forming or shaping and ornamenting vessels and articles of glass, and in the construction of furnaces and annealing kilns. May 25; six months.

John Hickman, of Walsall, Stafford, clerk, for improvements in the manufacture of cylindrical and other tubes. May 25; six months.

Alfred Vincent Newton, of Chancery-lane, mechanical draughtsman, for improvements in couplings for carriages, and in the attachment of wheels to axles. (Being a communication.) May 28; six months.

James Ashworth, of Rochdale, Lancaster, manufacturer, and Thomas Mitchell, of the same place, manager, for certain improvements in machinery or apparatus for preparing, spinning, and weaving cotton, wool, and other fibrous materials. May 29; six months.

Jonathan Harlow, of Birmingham, for improvements in the manufacture of bedsteads and other articles for setting or reclining on. May 30; six months.

Edwyn John Jeffery Dixon, of the Royal Slate Quarries, Bryntrafood, near Bangor, North Wales, for improvements in the manufacture of sinks and other articles of slate or stone. May 30; six months.

## LIST OF SCOTCH PATENTS FROM 22ND OF APRIL TO 22ND OF MAY, 1850.

T. S. Prideaux, of Southampton, gentleman, for improvements in puddling and other furnaces, and in steam boilers. Sealed April 26; six months.

Charles Cowper, of Southampton-buildings, Chancery-lane, for certain improvements in the treatment of coal, and in separating coal and other substances from foreign matters, and in the manufacture of artificial fuel and coke, and in the distillation and treatment of tar and other products from coal, together with improvements in the machinery and apparatus employed in the said purposes. (Being a communication). April 26; six months.

Lucien Vidie, late of Paris, in France, but now of South-street, Finsbury-square, advocate, for improvements in conveyances on land and water. April 27; six months.

Robert Dalgleish, of Glasgow, Lanark, in Scotland, merchant and calico printer, for certain improvements in printing, and in the application of colours to silk, cotton, linen, woollen, and other textile fabrics. April 27; six months.

Ethan Campbell, of the City of New York, in the United States of America, philosophical, practical, and experimental engineer, for certain new and useful improvements for generating and applying motive power, and for propelling vessels April 30; six months.

Robert Reid, of Glasgow, Lanark, manufacturer, for certain improvements in weaving. May 3; four months.

Maxwell Miller, of Glasgow, Lanark, coppersmith, for certain improvements in distilling and rectifying. May 3; six months.

Thomas Keely, of Nottingham, manufacturer, and William Wilkinson, of the same place, framework knitter, for certain improvements in looped or elastic fabrics, and in articles made therefrom; also certain machinery for producing the said improvements, which is applicable, in whole or in part, to the manufacture of looped fabrics generally. May 8; six months.

Peter Armand Lecomte Fontainemoreau, of 4, South-street, Finsbury-square, Middlesex, for certain improvements in the production of heat and light, which improvements are applicable to ventilation and the prevention of explosions. (Being a communication). May 9; six months.

Ethan Baldwin, of the City of Philadelphia, and State of Pennsylvania, in the United States of America, for a new and useful method of generating and applying steam, in propelling vessels, locomotives, and stationary machinery. May 9; four months.

Jacob Connop, of Hyde Park, Middlesex, gentleman, for improvements in melting, moulding, and casting sand, earth, and other argillaceous substances for paving, building, and various other useful purposes. May 20; four months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| May 23 | 2305 | James Nasmyth | Patricroft, Lancashire | Framing for a portable steam-engine. |
| 24 | 2306 | John Sutton | Stamford-street, Blackfriars-road | Adjustable inkstand. |
| ,, | 2307 | J. Harrison | John-street, Fitzroy-square | Boudoir piano-forte action. |
| 25 | 2308 | William Brodie | Airdrie | Tile machine. |
| ,, | 2309 | Marmaduke Osborn Bergin | Cork | Automatic fire-extinguisher. |
| ,, | 2310 | Alfred Bird | Birmingham | Filter. |
| 27 | 2311 | John Davenport | Sheffield | Graining comb. |
| 29 | 2312 | William Wright | Kilworth Co., Cork | Mill-stone furrows and feeder. |
| ,, | 2313 | Allan Livingston and Son | Portobello, near Edinburgh | Hermetical cradle for joining pipes suitable for water sewerage. |

## CONTENTS OF THIS NUMBER.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1400.] SATURDAY, JUNE 8, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

## TAYLOR'S PATENT LINTING MACHINES.

Fig. 1.

Fig. 2.

Fig. 3

Fig. 4.

Fig. 5.

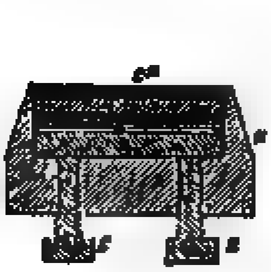
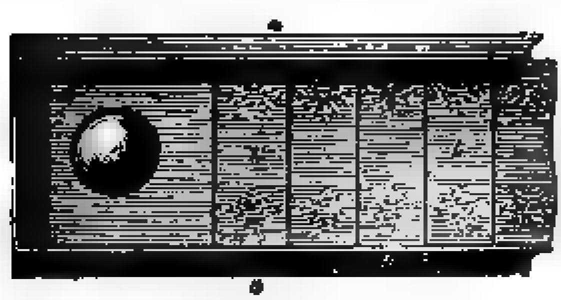


Fig. 6.



## TAYLOR'S PATENT LINTING MACHINES.

(Patent dated November 24, 1849. Patentee, William Garnett Taylor, Burton Hall, Westmoreland. Specification enrolled May 24, 1850.)

MACHINE-MADE LINT, the product of the machines which form the subject of this patent, though but a novelty of very recent date, has already acquired a great name in hospital and private surgical practice. The most inferior quality supplied by the manufacturer is pronounced by competent judges to be superior to the very best of the old sort. A distinguished surgeon has been pleased to say of it, "the arts have made in my time no greater present to humanity." A committee of officers having been appointed by the Army Medical Board to investigate and test the merits of the patent article, report as to a specimen of *third* quality, "that it is thick, soft, and absorbent;" "well calculated for water dressings and the application of medical lotions, and, indeed, most ordinary hospital purposes;" while of a "*second* quality," they certify that it is "*quite fit for surgical dressings of any description.*" If *second* and *third* qualities be so good, the reader may reasonably suppose that quality, the *first*, can leave but little, if anything, to desire. The softness and evenness of a specimen of the last now before us are very remarkable; it tears and spreads in any direction, and is of substance enough to staunch the deepest surface wound. The patentee describes no less than six different machines by which this article is (or may be) manufactured, but we must content ourselves with extracting from his specification the description of that which comes first in order:—

Fig. 1 is a front elevation of a linting machine embodying part of my improvements; fig. 2 an end elevation thereof; fig. 3 a plan; and fig. 4 a vertical section. The machine is represented in the engravings as ready for working. A, A, A, A is a framework, on the top of which is mounted a moveable frame B, which is jointed thereto by a back rail D, so that the frame B may be free to rise and fall when acted upon as afterwards explained; C is the knife or scraper by which the piling of the linen or other fabric, or the converting of it into lint, is effected; it is attached to the front edge of the moveable frame B, and rises and falls with it. $C^2$ is a bed, over which the web of cloth M to be piled or linted is carried immediately under the knife; this bed is formed of several thicknesses of felt or other suitable elastic substance covered with leather, as separately represented in figs. 5 and 6, and afterwards described. F is a shaft, which has its bearings on the two side rails of the framework, and is made to revolve by a band from some prime mover applied to the pulley G. $G^2$ is a loose pulley upon the shaft F, for receiving the band when it is desired to stop the machine without interfering with the prime mover. H is a tappet wheel upon the shaft F, which, as that shaft revolves, lifts the frame B and knife C by coming in contact with the bracket $F^2$. As soon as the tappet wheel drops out of contact with the bracket, the frame and knife again descend of their own weight, with the assistance of a spring $H^2$ attached to the head $H^3$ of the framework. $H^4$ is a screw by which the pressure of the spring $H^2$ may be increased or diminished at pleasure. I I are two other tappet wheels affixed to the shaft F, which wheels, in the progress of the revolution of the shaft, catch against brackets $I^2$ $I^2$ fixed to the front of a presser bar K, and bring that bar down upon the web. As soon as this presser bar is liberated from the action of the tappets, it is caused to ascend again by the action of a vulcanized India-rubber band or spring $K^2$, which is passed over the centre bar of the frame B, and is attached by its two ends to the presser bar. The ends of the presser bar travel in two slotted brackets affixed to the framework (which act both as stops and guides to it), so that, although the spring $K^2$ always exerts some degree of upward pressure, the presser bar cannot be drawn up too far to get beyond the range of the action of the tappets of the wheels I I. The cloth is wound upon the beam $M^2$, from one end of which there is suspended by a friction strap a weight $M^3$, to prevent the roller from turning too freely, and also to keep the web in a proper state of tension for being laid hold of by the feed and holding roller N. This feed roller is covered with carding cloth or wire teeth, which lay and keep hold of the cloth, preventing it from being drawn too rapidly forward by the scraping action of the knife. O is another roller, covered with felt, which is mounted in slotted bearings $O^2$ $O^2$, immediately over the feed roller N, and serves to press (by its weight) the cloth down upon the feed roller, so that the card teeth of the latter may uniformly take hold of the web across its whole breadth. A comparatively slow motion is communicated to the feed roller from the shaft F, through the intervention of endless screws $P^1$ $P^2$ and worm wheels $R^1$ $R^2$, so that each lift of the knife

is followed by but a very small advance of the cloth to be linted. If a web be put into the machine, as indicated by the dotted lines in fig. 4, and motion given to the shaft F, as before explained, the tappets upon the wheel H cause the knife to rise about three-quarters of an inch, and then allow it to fall down upon the web; but, as the cloth rests upon an elastic surface covered with leather, the knife but very partially enters or cuts into the warp and weft of the cloth. The instant the knife has thus fallen upon the cloth, and so laid hold of or cut into it, the presser bar K is also made to descend upon it by the action of the tappets on the wheels I I, and as the web had, previous to the fall of the knife, been drawn forward by the weight S so as to be partially stretched between the knife and the feed roller (being held by both of them) the descent of the presser bar causes the cloth to be drawn back underneath the knife, between which and the leather surface it meets with less resistance than from being drawn over the card teeth of the feed roller. The scraping effect thus produced by the web being drawn back underneath the knife, raises a row of pile upon the surface of the whole breadth of the web, and each successive stroke or fall of the knife being accompanied by the same movements, each stroke raises an additional row of pile upon the surface, which action is continued until the entire web is converted into the state in which it acquires the name of "lint."

The endless screws and worm wheels by which motion is communicated to the feed roller are so calculated that they shall make the web advance about one-sixteenth of an inch each lift of the knife, and the feed roller is, moreover, made to traverse from one side of the machine towards the other at each revolution of the cam wheel Z. The lateral travel thus given to the feed roller does not amount to more than one inch towards either side, but serves to give uniformity to the raised pile surface.

The machine is provided with a roller U in front, for the purpose of enabling the weight S to act instantly in stretching the cloth at each ascent of the knife. The form of roller which I have found most suitable for this purpose is represented in figs. 1 and 3. It is made of greater diameter at the middle of its length than at the ends, in order that the web may be kept from puckering or getting into folds under the knife.

Fig. 5 is a cross section, and fig. 6 a plan showing the manner in which the elastic bed $C^2$ underneath the edge of the knife is formed; *a a* are two ledges or lips which form a groove or channel in the upper side of the front rail of the machine, into which there are placed a number of small cross bars of wood *b b*. Beneath each of these cross bars there are placed two set or regulating screws *c c*, which pass through the bottom of the front rail, by means of which screws the elastic padding *e e* can be raised or lowered at pleasure. The attendant upon the machine can, by means of these screws, adjust with the greatest readiness the bed to the edge of the knife.

(For claims, see *ante*, p. 438.)

## THE EFFECTS OF MACHINERY ON THE WELFARE OF THE LABOURING CLASSES.

(Concluded from page 408.)

Hitherto, and in all that precedes, we have considered the effects of machinery on the employment of *the labouring classes in general*, meaning thereby, *all classes of labourers in all parts of the world*. It has been shown that so long as the income, or means of purchasing, of *the public* (meaning purchasers in all parts of the world), remains undiminished, then, whatever is saved in one branch of goods by the introduction of machinery, being spent on some *other* branch, the means of employment of labour are not diminished permanently in any case—the operatives dismissed from one branch, finding employment in some other, to which the purchasers have transferred whatever they have saved in that first branch of goods. In arguing the matter generally, and as a whole, it has been necessary thus to consider the labouring class as a whole, and without any reference to what country they belong to. But it is now time to turn our attention to this new question; What will be the difference between the effects of machinery on the British labouring classes as distinguished from the foreigners? And this is a question, a branch of the more general inquiry, to which the writers on these subjects have not given much attention. It is very possible for the introduction of machinery, in some cases, to be beneficial to *the labouring classes in general; i.e.*, throughout the world, without being so to our British portion of those classes. The way in which this may happen, is

very easily conceived. Suppose, as in the example we have taken, that one hundred men have been thrown out of employment in the cotton line, by the introduction of machinery, which has so cheapened cotton goods that the public have now, say 4,000*l.* at their disposal to spend on some other description of articles. Is it not obvious that they may, if they choose, spend this 4,000*l.* in such a way as not to give employment to one of these hundred dismissed operatives? If the public took them into their service as domestics; or if they choose to employ them to make more shoes or stockings, or coats, or chairs and tables, or if they chose to buy 4,000*l.* worth of any *British* manufactures—in any of these ways they would obviously be paying them the 4,0 0*l.*, just the same as before, only for some other sort of articles or some other service, than making cotton goods for them as at first. But suppose the public choose to spend this 4,000*l.*, thus saved in cotton, on foreign wines? Will such an expenditure as this come back in any way so as to benefit our hundred out-of-work labourers? Some political economists would strive hard, and do their best, to prove that *it would.* And it is certainly not *impossible* that such a thing should happen; but a little consideration will soon show *to what extent* our hundred dismissed cotton workers are *likely* to reap any benefit from such a way of spending the 4,000*l.* When this new demand for wine reaches the foreign wine-merchants, there are several cases possible: each of which we must examine separately, in order to see how they will bear on the employment of our dismissed hundred.

The first *possible* case is, that no more wine is produced than before, but the same quantity is now sold for 4,000*l.* more than before, the foreign wine-merchants pocketing the 4,000*l.* A second, and much more likely, case is, that more vineyards are cultivated and wine produced, to meet the increased demand. In the first case, the foreign wine-merchants have 4,000*l.* to spend which they never had before. The question is, *how* will they spend it? If they choose to lay it all out on British goods, then our hundred discarded cotton operatives may find employment in producing these goods. But if they spend it all on the productions of their own country, will not this entirely destroy all hopes of employment thereby being afforded to *our* operatives? No; it will not: for here again, everything will depend on *how* they lay out the 4,000*l.* on even their own country's productions. And, in considering this matter further (involving, as it does in fact, the whole question almost of the benefits of foreign trade), we may merge the two cases above mentioned, into the several investigations. For the only difference will be, that in the former case we have to consider only how the *wine-merchants* spend *their* profits; in the latter case, we have to consider how *other* people, who come in for some share of the 4,000*l.* in the shape of profits in *their* respective trades, &c., spend *their* profits. For the sake of distinctness then, let us suppose that it is on French wines that this 4,000*l.* is expended: and suppose that the French wine-merchants, in the first place, pocket the whole of this sum as increased profits—giving no more wine to their English customers than before. And suppose that they spend this sum on French manufactures—silks, for instance. Here again we have the same variety of possible cases as we had before—that is, the French silk-merchants or manufacturers may pocket the whole sum, giving no more silk goods than before to their customers; or they may only get a portion of the 4,000*l.* as increased profits. To avoid all this endless variety of *possible* cases, let us take that which is most likely to happen in reality; viz., that every fresh demand for goods will be met by an increased supply, having the usual effect of increasing the profits of the merchant and manufacturer, and also giving fresh employment to some hands or other. Thus, then, let us suppose that the French wine-merchants only gain 1,000*l.* out of the 4,000*l.*, as increased profits: the other 3,000*l.* going to the cultivators of the fresh vineyards. Now here there is, at once, a *fact* of the 4,000*l.* completely and utterly lost for ever, *as a means of employing the British operative.* The French vine cultivators, however, get a portion of the 4,000*l.* as wages. Here again, there is a chance for the British operative. For the French vine-dresser may spend some part of his wages on English manufactures, just as well as the French wine-merchant. And even the portion of his wages which is spent in food, and paid over to the French farmer, may also itself be

spent on English manufactures by the farmer. But, on the other hand, it is just as possible for not one farthing to get back to England in payment for English labour and goods. For instance, the French wine-merchant may spend the 1,000*l.* on French manufactures: so may the vine-cultivators spend their increased wages on French goods.

But it may be asked, "Even in this case, where all the sum saved by machinery in English manufactures, is thus transferred into increased expenditure on French manufactures,—even here, may not the French manufacturers and operatives themselves spend *their* increased profits and wages thus obtained, on English goods?" Certainly, they *may*: but they *also may* spend them on French wines instead. And so, take whatever case or possibility you please, the ultimate effect on the means of employing the English operatives remains still doubtful. Facts alone can settle the matter and show the actual result. In this part of the investigation, however, we are merely examining general principles, and must leave all reference to historical and statistical details to another place. This much, however, we may add to the above general considerations: —that, irrespective of the way in which any of the persons who gain any part of the 4,000*l.* in France, chose to spend their increase of income, the transfer of this capital of 4,000*l.* to France, may have the following consequences:—

1st. If it finds its way to the French manufacturers, they may thereby be induced to introduce machinery into *their* business, and this may have all sorts of reflex influences on the English operative and manufactures.

2nd. If its ultimate effect be to *raise wages* in France (in any department of employment, whether of the vine-dressers, manufacturing labourers, &c., &c.), this may tend to increase the population in France, and again to cause a reflex influence on English labour.

The latter of these possible consequences is incompatible with the first (at least for a considerable period.) For, if the capital (transferred from England to France, in the way we have supposed), be sunk in machinery by the French manufacturers, there will be no rise of wages to the French operative, but more probably the reverse. But, let us take the two consequences successively into consideration, and see how each of them may affect the English operative.

1st. Then, suppose there is an increase of French machinery. The result will be similar to the results of the same event in England. French goods will, most probably, become cheaper, and the English purchasers of such goods save something which they may spend on their own country's productions, and give increased employment to British operatives; also the French purchasers will save something, and be enabled to spend their savings, if they chose, on English goods. And the French manufacturer himself may spend his increased profits on British goods.

2nd. But suppose, instead of this, that the English capital transferred to France, increases the wages of some class or other of French operatives (those engaged in the growing and manufacture of wines will, of course, come in for the principal benefit). If the number who receive these wages remains the same as before—that is, if the population among whom the English capital is distributed in the form of wages, be not increased—there is a good chance of some part of these increased wages, being expended in the purchase of British goods. But, if this portion of the French nation increases in numbers—the whole of the increased wages, or a considerable part at least, will necessarily be spent in food.

In general, we may remark, that, *the better off* any nation is,—the less straitened other people are for food and necessaries, the better it is for us. For their surplus of food or other things will always be exchanged for the goods of other nations. Suppose, for instance, the French have only barely sufficient to live upon; it is obvious, that they could not purchase any British goods or afford employment to British labour. The higher, therefore, the wages of the French operative, the better for the English operative; *provided this high rate of French wages has not been caused at the expense of the British operative.* This last, however, *would be* the case, under the circumstances we have supposed. For, trace the series of effects: (1). Introduction of machinery into English cotton factories. (2). Hands thrown out of work. (3). Cotton goods cheaper. (4). Purchasers of cotton goods

save some thousands. (5). And spend these thousands on French wines. Now cross the channel. (6). Increased profits, or wages to all concerned in the production of these French wines. (7). Only *a portion*, perhaps nothing at all, out of these increased French profits and wages, spent on English goods.

We have here touched on one of the most intricate, and complicated questions in Political Economy; viz., the "Benefits of Foreign Trade." Some of these benefits are obvious enough; we get, by means of it, thousands of our daily comforts and luxuries, which otherwise we could not get. Every time we taste our tea, coffee, sugar, &c., &c., we are tasting these benefits. But is it absolutely impossible, that these benefits may be gained by *some individuals at the expense of others?* For example, to take such a case as we have just been supposing; may not an English capitalist spend that money on French wines which he would (or at least, *might*) otherwise have spent on some article of English labour, and thus have contributed to the support of English labourers? And may not this be effected, *without any benefit, direct or indirect*, coming back to the English operative, from this expenditure on French products? Political economists are very unwilling and reluctant to admit such a possibility, and it is certainly true, that even such an expenditure on foreign goods may, and does, come back, in a variety of ways, with a beneficial influence, even on the English labourer: but is this *always* and *invariably* the case? Is it the case in the majority of instances? We have histories of commerce; but there is very much wanted a history of the *effects* of commerce on the labouring classes of the nations between whom this commerce is carried on, pointing out not only such palpable and obvious consequences as the benefits of increased cheapness to the consumer, but the effects of such improvements in production as we have been contemplating, on the demand for and remuneration of labour.

*(To be continued.)*

*Errata.*—Page 404, col. 2, line 7, there should be no stop between "introduced" and "supposing." Line 10, for "*exclusive*" read "*inclusive.*" Line 33, for "*wages*" read "*ways.*" P. 405, col. 2, last line but 3, for "*improving*" read "*diminishing.*" P. 406, col. 2, line 21, for "*doubled,*" read "*divided.*" P. 407, col. 2, line 18, instead of "*far,*" read "*for.*"

MATHEMATICAL PERIODICALS.

(Continued from page 270.)

## XXI. *The Mathematical Magazine.*

*Origin.*—This periodical was commenced in April, 1761, under the title of the "The Mathematical Magazine, and Philosophical Repository. Containing a variety of Original Pieces in all parts of Mathematical Science." The title appears to have been issued with the first number, and is expressive of what the work was intended *to be* rather than of what it really *is;* for although "Vol. I." occupies a conspicuous place in the centre of the page, as if boldly to intimate its being the *first* of a numerous progeny, the conductors would seem to have miscalculated the productiveness of their literary bantling, which terminated its existence, so far as we are aware, with the *fifth* number in August of the same year. In the copy from which the above is cited, the Mathematical portion occupies eighty pages and a copper-plate engraving of "Andromeda" forms a frontispiece to the volume.

*Editors.*—The names of Messrs. George Mitchell and Thomas Moss are announced on the title page as contributors of the "Original Pieces," and from internal evidence it is most probable that these gentlemen were the conductors of the work.

*Contents.*—The usual contents of each number are,—Mathematical Papers on various subjects, Original and Translated; Astronomical Discussions and Calculations; Philosophical Queries and Answers; Mathematical Questions and Solutions. In order to buoy up the *dead weight* of a purely Mathematical Magazine, two or more sheets of "A New and Universal Dictionary of Pure and Mixed Mathematics" were issued with each number, which had been carried as far as the article "Air-Pump" when the Magazine was discontinued. A good engraving of an "Air-Gun" and Mr. Smeaton's "Air Pump" forms "Plate I." of this portion of the work. The principal portion of the Mathematical Papers are of an astronomical character, as might be expected from the known partialities of the principal Editor for that interesting science. The following enumeration will serve to give an idea of the contents of the several papers:

I. A New Solution of Kepler's Problem. By George Mitchell, Teacher of the Mathematics.

*** In this paper two "Analogies" and a "Practical Rule" with Examples are given. The demonstrations exhibit a curious instance of the transition state of Trigonometrical Notation, for in the *first* we have "$t$ = the tangent of AS$p$," and in the *second* are found the forms "sin. $\epsilon$," "$\frac{\text{sin.} \frac{1}{2} a}{\text{cos.} \frac{1}{2} a}$," agreeably to the plan adopted, probably for the *first* time, by Simpson in his "*Miscellaneous Tracts.*"

II. To determine exactly the beginning and end of a Lunar Eclipse. Translated from the works of a celebrated foreign mathematician.

III. To correct a Meridian Line. From the same.

*** In these papers the notation sin., cos., tan., cotan., &c., is strictly adhered to.

IV. A New Method of Computing Solar Eclipses, reduced to Short Rules. Translated from the *Latin* of S. Klingenstiern, Member of the Academy of Sciences at Upsal.

V. Calculations of the Eclipse of the Moon, which happened May 18, 1761. By C. Brent.

VI. A Calculation of the Transit of *Venus* over the *Sun's* Disc, June 6, 1761. By Mr. E. Kimpton, jun., of Barkway.

VII. An Example of a General Rule for Tabulating a standing Spheroidical Cask. By Thomas Moss.

VIII. A Curious Letter from Mr. Abraham de Moivre, F.R.S., to Dr. Edmund Halley, F.R.S., "upon the right method of finding the rate of interest in Annuities, and of continuing it."

IX. Concerning some New Observations on a Satellite of the Planet Venus. By M. Baudouin, communicated by J. Bevis.

X. Concerning a *fourth* Observation of the Satellite of Venus, made by M. Montaign at Limoges. By M. Baudouin, communicated by J. Bevis.

*** In these two Memoirs, M. Baudouin insists "that the Satellite of Venus is no longer a matter of uncertainty," although he himself sought for it in vain on the 17th May; subsequent Astronomers, however, have found themselves unable to verify these conjectures and supposed "observations." The Certificate of the Academy of Sciences, ordering the printing of M. Baudouin's remarks is given at the close of the second Memoir; it is signed by La Caille, Lalande, and countersigned by De Fouchy, Perpetual Secretary of the Royal Academy of Sciences.

XI. Exact Observations of the End of the Transit of Venus; viz., at

*Greenwich*, by Mr. C. Green, magnifying power 55.

*Spital Square*, by Mr. J. Canton, ——, ——, ——, ——.

His Royal Highness the Duke of York's, *Leicester Square*, by Mr. Short and Dr. Bevis, magnifying power 140.

*Liskeard*, by the Rev. Rd. Haydon, ——, ——, 55.

*** It is observed in a note to this paper that none of these observers saw anything of the Satellite of Venus, which "had been expected by some in France;" but a correspondent in the *London Chronicle* of May 18, testifies to having seen it during his observations at St. Neots, in Huntingdonshire.

XII. The Demonstration of the New Method of Computing Solar Eclipses, given in Art. IV. By M. Klingeniern.

XIII. Ephemeris of the Eclipses of Jupiter's Satellites, for August, September, October, November and December, 1761. By the Conductor.

*** This paper was intended to assist in more accurately fixing the position of the Satellites, so as to determine the Parallax of Venus.

*Questions.*—The number of Mathematical questions proposed in this periodical is 35, of which 25 received answers. Of these nine belonged to Geometry, seven to Trigonometry and Astronomy; three to Arithmetic, and one each to Mechanics, Mensuration, Fluxions, Algebra, and Chances. In this, as in most periodicals of a later date, it will be observed, that Geometrical Exercises preponderate; a sufficient proof that these studies were gradually extending amongst Mathematical students generally. Both the Conductors and the Correspondents invariably quote the writings of Thomas Simpson; his *Trigonometry*, *Appendix to Algebra*, and *Select Exercises*, being the works referred to. In the *first* Number of the Magazine (April 1761), he is personally introduced as "Mr. Simpson, F.R.S., Professor of Mathematics in the Royal Military Academy at Woolwich," but in

the *last* number (August 1761), he is spoken of as "that very profound Mathematician, *late* Professor, &c.;" so that the period of Mr. Simpson's resignation is pretty clearly pointed out.

Ques. 3, by Mr. Charles Barton gives "two points, and the magnitude and position of a circle, to draw a tangent to the circle; so that the sum of the two perpendiculars falling thereon, from the two given points, may be equal to a given line:" a problem to which the proposer gives an elegant "Construction and Demonstration."

Ques. 4, by Mr. T. Moss, investigates "the *true* quantity of liquor that any given spheroidical cask will contain upon every inch of its depth, when its axis is perpendicular to the plane of the horizon, by a *general* rule which may be of *real* use to the practical gauger."

Ques. 7, by "Mr. C. Brent, *Author of the Compendious Astronomer*," determines the *true* weight of a "tub of Irish butter" by means of a false balance.

Ques. 8, proposed by Mr. Wood, and answered by Mr. Jeremiah Ainsworth, demonstrates the rule for finding the area of any triangle when two sides and their included angle are given.

Ques. 11, proposed by Mr. Ogle, and answered by Mr. Barton, gives a "theorem for describing an oval, whose diameters are in any given ratio, by circular arcs," and also finds "the area by means of those arcs." The method of description forms one of those given by Bonnycastle in his "Introduction to Practical Geometry and Mensuration," and may also be found in several other works.

Ques. 20, proposed by Mr. Barton, and answered by Mr. Ogle, divides "geometrically, a given right line into two parts, so that the square of the greater part is equal to half the sum of the squares of the given line and the lesser part."

Ques. 23, proposed by *Geometricus*, and "answered by Mr. Thomas Moss, the proposer," investigates "geometrically, two theorems for determining the solid contents of the hoops of the frustum of a square pyramid; which are formed by cutting the extremities of the two parallel bases, by a diagonal plane." Two practical rules are deduced from the demonstration.

Ques. 25, determines the value of the expectation of a person who is "entitled to one guinea, if he throws, precisely 12 heads, at four throws, with 10 halfpence:" it was proposed by Mr. Kimpton, and answered by Mr. Moss.

Many of the remaining exercises are worthy of enumeration, but the above may suffice as a specimen of the contents of this portion of the work.

*Contributors.*—Allen (Spaldiniensis); Ainsworth; Barton; Barker; Dr. Bevis; Brent; Cave; Green; Hale; Harris; Hughes; Kimpton; Leigh; Millington; Moivre; Moore; Moss; Ogle; Randle; B. Rogers; Smith; Thompson; &c., &c.

*Publication.*—The publication took place monthly; it was "printed for J. Wilkie, at the *Bible* in *St. Paul's Church-yard;* and sold by all Booksellers in *Great Britain* and *Ireland*."

THOMAS WILKINSON.

Burnley, Lancashire, May 16, 1850.

## THE BOOMERANG PROPELLER.

Sir,—In your notice of my invention of the Boomerang Propeller, in your Number for December, 1848, I first discovered that it was not understood, and I was neither surprised nor disappointed, having been obliged to leave England before I could complete my experiments, or give a full description of the instrument.

The letters of my friends tell me, that it would be almost hopeless to attempt, at this distance, whatever may be the merits of the invention, to force it upon public notice. At this greatest possible distance from London and at considerable expense, I am nevertheless endeavouring to bring this invention into operation.

Accidental circumstances, occurring at intervals of many years, and in both hemispheres, have led me at length to the completion of this propeller. To a remark of Baily, in 1838, a hint from Brunel in 1847, a lecture of Professor Cowper, in 1848, and recent experiments of my own in Port Jackson, this invention owes its completion, although for its origin, I am wholly indebted to the savage of Australia.

As I am sending home three patterns fit for use, of 3 feet, 5 feet, and 6 feet diameter, I shall not trouble you with a description, but confine my communication to one or two facts.

*Port Jackson,*
*Wednesday, Oct.* 10.

A boomerang propeller, whose dia-

meter was 22 inches, and the threads of whose screw, were at a distance equal to the diameter or 22 inches, was attached to a shaft projecting through (a stuffing-box, in) the cut-water of a boat.

To this shaft, the rotary motion was given by a chain-wheel and pinion, worked by a steam engine of about three men's power, producing five revolutions of the screw, by each stroke of the piston; a distance of 660 yards was traversed in exactly six minutes, when the strokes of the piston were thirty-six in a minute.

The boat was thus propelled 22 inches at each turn of the screw, for $36 \times 5 = 180$ revolutions periminute, and $180 \times 22 = 110$ yards, and $110 \times 6 = 660$ yards, which is exactly the distance traversed in six minutes.

*Friday*, *Oct.* 12.

During heavy rain, when the steam had not been brought to full pressure, the same distance was traversed in eight minutes, the stroke of the piston being twenty-eight per minute $-28 \times 22$ inches $= 82$ yards, and $82 \times 8 = 656$ yards, or less by four of the true distance.

Each turn of the screw advanced a clumsy boat 22 inches. There is, therefore, *no slip* in the working of this propeller, which may even be useful in measuring distances. Want of steam power was the only limit to these experiments, and it remains to be ascertained at *what* velocity, or whether at *any* rate of speed, there would be any slip at all.

The freedom from all "choking about the centre" which attends some other kinds of propellers, may be accounted for, according to those principles of hydrostatics which relate to *pressure on oblique surfaces* under water: the *centre of pressure* in this case, being quite clear of every part of the surface of the propeller.

From the above-described experiments, which show the distance traversed exactly equal to the distance given by the spiral motion of the propeller, and from its form the centre being clear, and therefore avoiding any possibility of choking, it may reasonably be inferred, that an augmentation of velocity in the propeller will add to the speed of the vessel in an increasing ratio. For it is manifest, that every augmentation of velocity in the operating surface will increase the density of the resisting medium acted on in the rear, and at the same time increase the vacuity in the front of the propeller, whilst there is no increase of any obstruction by choking.

I am, Sir, your obedient servant,

T. L. MITCHELL.

Sydney, N.S. Wales, Oct. 22, 1849.

## MESSRS. ROWAN AND SONS' METHOD OF VENTILATING FACTORIES.

In taking a hasty survey of the town improvements and trade of Belfast, and, while finding that the commerce is rapidly extending—while new sources of trade are gradually opening up with various portions of the world—and while a more healthy tone is being imparted to our staple trade, the linen manufacture, it must, nevertheless, be admitted that the sanitary condition of the operatives, even while employed in the works, has been hitherto held in too little estimation by many of those best entitled to preserve the health, as well as the morals, of the working population. The want of sufficient ventilation in very many of our great manufactories has been lamentably experienced as well by the employed as the employers. Our attention has been forcibly drawn to this important subject by having inspected an extensive flax-spinning mill, which is now in progress of erection on the ground at Milewater, the property of Messrs. J. Rowan and Sons. An entirely new system of ventilation has been discovered by these practical engineers, and is now in the course of being adopted in their new concern—a sketch of which Mr. Fulton, the contractor of the works, kindly laid before us. The whole application of the system is partly confined to the rows of hollow columns which support the floors of the building. A sufficient opening is made near the upper part of the column to admit a ventilator, which is placed in a position to receive a portion of the fresh air constantly supplied by the outer door of the building. The columns are placed directly one above the other (as is the case in other mills), so as to form a complete funnel, carrying off all foul evaporations at top of the mill, while the columns are so constructed that, on the upper extremity of each, a trumpet-shaped conveyancer attached completes the apparatus, and will, when carried out, perform the most perfect ventilation beyond the possibility of failure. In addition to the above are ventilators placed at the top of each window, inside, acting independently of the central columns, on a new principle, which conducts the evaporation at once from the room in which it is placed, by a funnel being built in the wall, whence it is dis-

charged beneath the window-sill of the next story. In this ventilator, which extends across the whole breadth of window, is a moveable valve, which is worked like the throttle-valve of a steam engine, and can be set at pleasure by a cord being attached to it.—*The Northern Whig.*

[Messrs. Rowan and Sons' plan of ventilation is very scientifically conceived, and well-deserves to be universally adopted.—Ed. M. M.]

## POWNALL'S PATENT PASSENGER REGISTER.

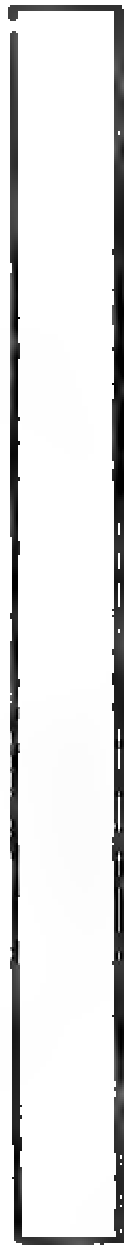
[Patent dated November 17, 1849. Patentee C. J. Pownall, Esq. Specification Enrolled May 17, 1850.]

The more certain persons can be of pocketing the entire net returns from any adventure or speculation in which their capital is embarked—the smaller the deductions they have to make for such incidents as peculation of servants, bad debts, errors of account, &c.—the more cheaply, of course, they must be able to afford the use of that capital, and the greater must be the advantage conferred on the public by their enterprise. Theatrical property is, proverbially, the worst of all sorts of property, though the prices of admission have at all times been high; but Garrick was wont to say, that "were it not for the trouble they had to keep the treasury honest, they might reduce the prices one-half, and grow rich." So also with cab and omnibus property: although all the world now-a-days rides, nobody ever hears of a cab or omnibus proprietor making money—a thing which, of course, could not be in the ordinary course of affairs, if the tribute of all the world went where it ought to do. The object of the invention we have now to introduce to our readers is, to put an end to these serious drawbacks on the investment of capital in that numerous class of undertakings of which theatres and public conveyances are prominent examples; and this we think it will do most effectually. The principle of the invention consists in "causing the entrance of every person into or upon a carriage or other conveyance, or into or upon any passage way, to complete an electric circuit or connection with a voltaic battery suitably placed, and such completion of the circuit to actuate a system of wheel-work and numbering index connected therewith, *whereby the fact of such entrance, and any number of entrances, will be unerringly ascertained and registered.*" The following details we extract from Mr. Pownall's specification:—

The figures annexed represent this invention as applied to an omnibus.

Fig. 1 is a plan of the hind step in an expanded state; fig. 2 exhibits an edge view of it, and figs. 3 and 4 are cross sections of it in different positions. It consists of two leaves or platforms, H, T, placed one above the other. The under leaf (H) is connected to the floor of the hinder part of the omnibus by brackets or stays, GG, and remains always in a fixed position with relation to the body of the carriage. The upper leaf, I, being that on which the passenger treads is connected to the under leaf by hinges. $K^1$, $K^2$, are two steps, or bands of metal, one affixed to the upper leaf I, the other to the under one H, and which occupy positions immediately opposite to each other, so that when the two leaves of the step are pressed together these metal bands come in contact. LL are springs, which are interposed between H and I, and serve to keep the metal bands, $K^1$ $K^2$, from coming in contact unless when some weight, such as that of a person of average weight treading upon it brings them together. MM are wires which lead from the bands $K^1$ $K^2$, to a galvanic battery N, placed immediately under the floor of the carriage, or in any other convenient part. R is the registering apparatus, which occupies a position alongside of the battery. Fig. 5 is a front view of the battery and registering apparatus; fig. 6 is a back view of the registering apparatus on an enlarged scale. AA is a system of wheel or clock work; BB, a ratchet wheel; D, a piece of steel, and E an electro-magnet, composed of a piece of soft iron enclosed in a helix of wire. The action of the apparatus is as follows:—Every time a person treads upon the upper leaf of the step, the two bands, $K^1$ and $K^2$ are brought into contact, and a metallic circuit completed in connection with the battery N. The current flowing through the electro-magnet E, attracts to it the piece of steel D, which in its turn causes the pallet C, to push round the ratchet wheel one tooth, which movement of the ratchet wheel is transferred to the index-hand F, of the numbering-dial R, and causes it to move forward one division; of course the moment the pressure is removed from the step of the omnibus the circuit is broken, and the apparatus ceases to operate. As, however, the exits, as well as entrances

Fig. 2.



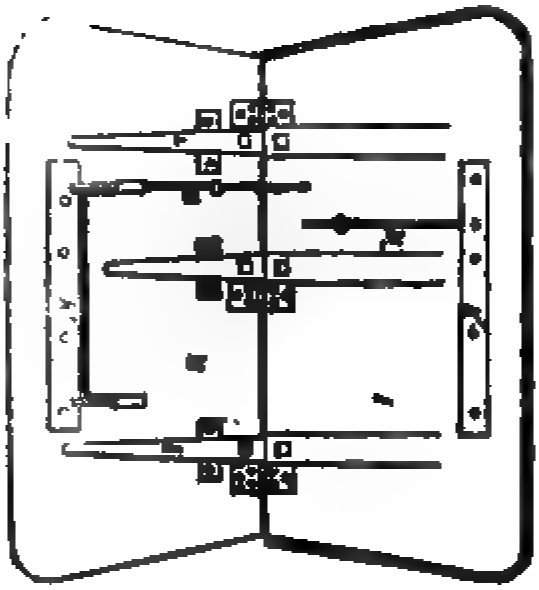


Fig. 1.

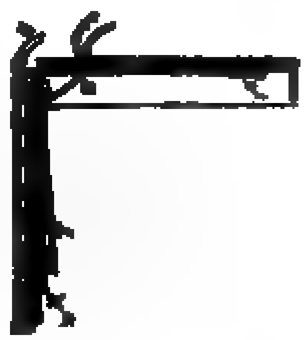


Fig. 3.

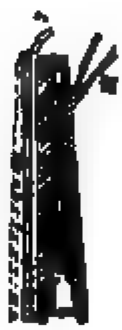


Fig. 4.

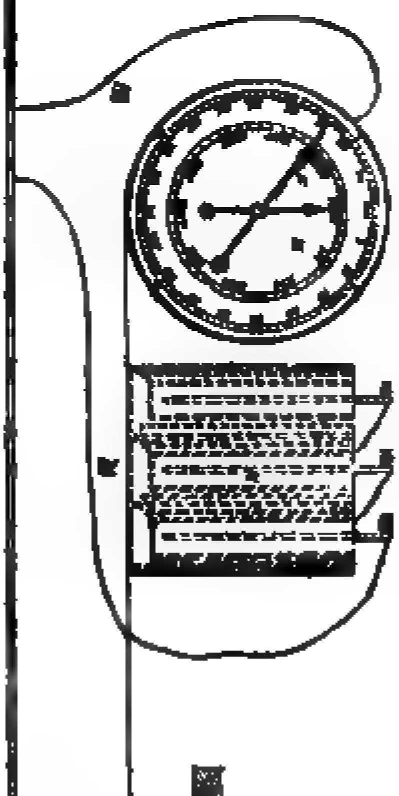


Fig. 5.

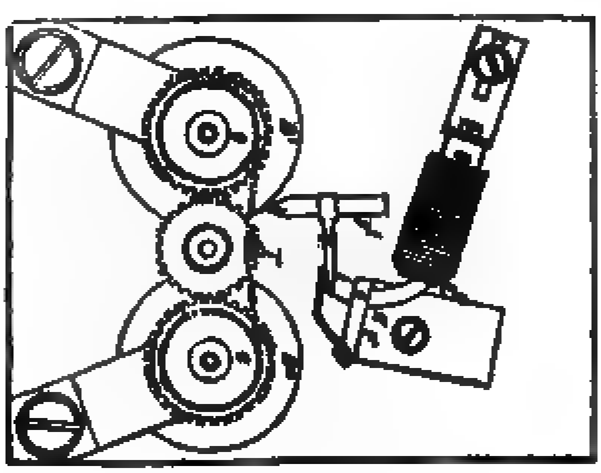


Fig. 8.

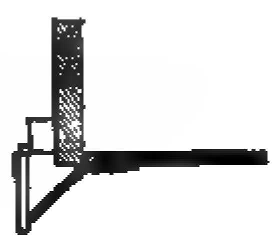


Fig. 7.

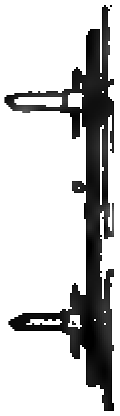


Fig. 9.

Fig. 6.

of passengers must necessarily be thus retarded, the index will mark double the actual number of passengers to be accounted for.

In the engraving, fig. 5, the dial is shown as calculated to indicate from 1 to 5,000, by the employment of two hands, one of which, F, is connected to the first motion of the instrument, and indicates from 1 to 160, and the other, *f*, is connected to the second motion of the instrument, moving over one division only for each entire revolution of the other hand, and thus indicating hundreds and thousands. To guard against the fraudulent insertion of any substance between the under and upper leaves of the step with a view to prevent the bands coming together, the space between the two leaves should be inclosed all round; and to prevent also two persons pressing on the step at one time, in which case the entrance of one only would be registered, the step should either be made narrow, so as to render this impracticable, or have guards or fenders on each side, with such interval only between as would allow the passage of but one person at a time. A guard is also attached to the lower part of the door (see fig. 7), which covers the step when the door is closed.

Steps of the same construction as that before described, and connected in like manner to the battery, may be made use of for the ascent to the roof or outside of the omnibus.

Moreover, instead of the numbers being indicated upon a dial, they may be marked by the decomposition of some chemical substance on paper or cloth, or by a marking point upon paper; in which cases the strip of paper or cloth, or other substance will require to be kept in motion, that the marks may fall upon separate portions of it, and not always on the same place. Fig. 8 is a front elevation, and fig. 9, a plan of machinery suitable for the purpose. A A is a case containing a set of clockwork actuated and put in motion by a main spring of the usual construction. $B^1$, $B^2$, are two rollers affixed to the outside of the frame of clockwork, and put in motion by the train of wheels CC. The paper, or cloth to be marked is wound upon the roller $B^1$, and as it is unwound is received upon another roller $B^2$. D is an electro-magnet composed of a piece of soft iron enclosed in a helix of wire; E, a bent lever, which has its axis in the bracket F; at its upper end it carries a piece of steel, $E^1$, and at its lower end a marking point, or pencil, $F^1$, immediately beneath which there is a roller T, over which travels a ribband of the paper, or other substance which is to be marked. When the electro-magnet D is excited by the flow of the electric current, as at each completion or making of the circuit as before explained, then the piece of steel, $E^1$, placed on the end of the bent lever E is attracted towards the electro-magnet, and for the time it is so attracted, keeps the point or pencil in contact with the ribband of paper underneath which is to be marked, and as that ribband is kept by means of the clockwork constantly passing from off the one roller on to the other, each "make" and "break" of the circuit will thus cause a distinct mark or trace to be left upon the paper.

I give no preference to any substance by which the paper or cloth may be saturated for the purpose of being decomposed by means of the electric current, as there are many well known substances which will answer the purpose, and are already in use in telegraphic arrangements.

Apparatuses of either of the sorts before described may be used in connection with passage ways of all descriptions—such as public gardens, landing piers, toll-paying bridges, &c. All that is necessary is, that the persons traversing these passage ways should be obliged, in doing so, to tread upon movable platforms, or to pass through wickets or turnstiles connected, as before described, with an electric battery and registering apparatus. (For claims, see *ante*, page 416.)

## SUGGESTIONS FOR THE IMPROVEMENT OF NAVAL GUNNERY.

Sir,—In Number 1390 of the *Mechanics' Magazine*, it appears that Sir Samuel Bentham had, during the long period of thirty-five years, repeatedly proposed experiments and urged the need of them, in regard to some of the fundamental particulars on which the efficiency of naval armaments depends—"not *partial* experiments, but based on general principles." On no one particular had he more urgently and repeatedly exhibited the need of such experiments than on that of armament; several successive Lords of the Admiralty coincided with him in opinion, but various circumstances prevented the adoption of the experiments he proposed—the chief obstacle having been, that the providing of naval ordnance is not entrusted to the Department of the Navy, but to that of the Ordnance; hence the circuitous and formal modes of communication between the Admiralty and Ordnance Boards formed a bar to concerting together the minutiæ of experiment. Sir Samuel

himself, it must be said, from the time of his appointment of Inspector General of Naval Works, uniformly received from the Ordnance Department the most cordial and courteous co-operation; but it was as an individual, entrusted individually with a duty, that the intercourse had place on his part, free from the shackles of official forms.

In the hope, from time to time, that at least some of the requisite experiments would be determined on, Sir Samuel at different periods noted points to be ascertained. The following paper has been extracted from his *notanda* on the subject.

Many of the experiments indicated, and desiderata to be obtained, seem purely of a mechanical nature, and therefore may be worth the attention of your mechanical readers; your metallurgical ones will also find matter for their consideration. It can hardly be forgotten that the carronade was the invention and production of the private company from which it took its name, and some of the experiments indicated might lead to its reinstatement in the navy, though it be not now in fashion. Some of the experiments seem, it is true, to require such facilities as are, perhaps, only to be found in great ordnance establishments; yet many others admit of being made by private persons—nay, in a *room*, as Sir Samuel has said. Indeed, from principle, he advocated and practised the making first experiments on a small scale, so that, with little expense of cash or trouble, indications might be obtained of particulars worthy of farther investigation.

### *Extracts from Sir Samuel Bentham's Papers.*

Attention having of late been much directed to the amelioration of the mode of arming our vessels of war, some great improvements have in consequence been introduced, but much remains yet to be done, more particularly as steam navigation must give rise to a variety of new evolutions in naval warfare, and must call for considerable deviations from established practice.

In projecting improvements, it cannot but be useful to regard them under two general divisions—namely, improvements that aim at perfection; improvements that have for their object the making the best use of the immense and costly stock the nation already possesses of vessels, guns, carriages, and their several appendages.

As to improvements aiming at perfection, my experience, joined to the *rationale* of the subject, enable me to assert that a series of scientific experiments are wanting as regards the missile itself, the gun which throws it, the apparatus which supports and points the gun; in short, every part of the whole apparatus, including the vessel itself. Until these shall be made, no rules for general observance can be laid down on good grounds. The requisite experiments are, however, neither difficult to devise or carry on, nor costly, considering their importance, nor tedious in execution.

In regard to the better application of the naval stock we already possess, our experience, and the facts already known, might enable very great improvements to be made in the application of that stock.

It is known that the larger and the heavier be a shot, the farther it will go, and that when it strikes against an object, the greater will be the havoc made; this points to the introduction of ordnance of greater calibre than is customary in naval equipment,* but also to the uselessness of the greater part of our existing stock; yet that stock is of too much value to be thrown away. What part of it, then, could be advantageously still employed in naval warfare?

Experience teaches us that a ball thrown from a 32-pounder, nay, even from a 24-pounder, if striking at an angle not very oblique, is capable of penetrating and passing through the side of the largest vessels, as they have been hitherto built. Experience has also taught us that a shot thrown from ordnance of lesser calibre, up to 12 or even 18-pounders, seldom, if ever, passes through the sides of vessels of the larger descriptions; but that if a ball, from even an 18-pounder, strikes it, the shot remains imbedded in the ship's side, without doing material injury: thus it is indicated that, so long as ships remain of their present thickness, we may safely

* This was written about the year 1830; since that time, ordnance of very large calibre has been extensively introduced for the armament of ships of war.

continue the use of our great stock of 32-pounders for naval warfare generally, and even of 24-pounders for many purposes. Our lighter pieces can only be advantageously employed for such purposes against an enemy's men on deck, or against boats. It must be remembered in regard to all armaments, when looked to in the gross, that their extent must be limited by the amount of money that can be bestowed upon them: on this account, a primary object is to make the most of the *materiel* of the navy which we already possess, although that may not be the best known.

As to improvements aiming at perfection, and the need for experiments on which to ground them, the different proportions in the length and weight of artillery on board ship may serve as an example; for instance ***:* these several proportions cannot all be right, nor do they vary according to any real particular purpose, since mortars that are intended to throw shot further than any other piece of ordnance, are the shortest of all pieces of artillery.

In making experiments on ordnance, the gunpowder should, for all of them, be of the same kind; and on each different day means should be taken to ascertain that the powder has not suffered deterioration in quality from exposure to a moist atmosphere or otherwise.

Much inaccuracy in experiments has been said frequently to arise from the inequality of the balls employed. Care should, therefore, be taken to weigh and gauge all the balls made use of.

In all experiments with guns, one cause of great inaccuracy has generally been overlooked—that of the degree of heat of the gun; on this account, it would be desirable to make many experiments with small guns, capable of being managed in a room even, and, after every explosion, to immerse the gun in water, or to bring it by some other means back to the same temperature it was of at first.

The improvements that may be hoped for in guns themselves, are in point of 1st, material; 2nd, of form as to throwing the shot; 3rd, of the chamber; 4th, as to thickness of the parts respectively, proportioned to the strains respectively upon them; 5th, in weight, by the absence of all superfluous parts, and by abandonment of superfluous length.

In point of material, the desiderata are, that it should be that of which a given weight should be of the greatest strength, subject to the economical consideration of comparative cost, and that it should not be liable to deterioration by rust or other chemical decomposition, or by abrasion.

Query.—Can wrought iron be manufactured at a price which should place it in competition with cast iron for large guns?

Can wrought iron be connected with cast iron in fusion, so that the cast iron shall not break from the wrought?

Can iron guns be lined with a metal not liable to rust, as copper or brass, either cast in, or put in as a tube, and pressed in in vacuo, or brazed or soldered in?

What would be the cost of cast steel for guns?

By my experiments in Portsmouth Dockyard, the good effect of hammering a metal after it is cast has been proved; and this not only in the instance of pure copper, but of the mixed metals used for guns; the strength of the metal has thereby been increased a third, yet it does not appear that any improvement has been made in consequence in the manufacture of guns.

Query.—How much would the strength of the gun be increased by hammering it, and that in respect of the different metals of which it might be made, and in proportion as percussion might have been given by a large or a small hammer, and by blows more or less rapidly reiterated?

2ndly. As to the form of gun best suited for throwing the shot.

It may be assumed that the length of the gun should be sufficient to afford space for the decomposition of the whole of the charge of powder before the shot

* The instances adduced by Sir Samuel are omitted, as not referring to ships of the present day; but that differences of the same kind still continue is abundantly proved by documents published with the Report of the Select Committee on Navy Estimates, 1848. Page 719 gives "An Account of Ordnance Stores for an 80-gun Ship," among which are 8-inch guns of 9 feet long, 65 cwt. each; 32-pounders of three different lengths and three different weights—some of 9½ feet long, 56 cwt., others of 9 feet long, 50 cwt., and the third variety 8 feet long, and no more than 42 cwt. Surely they "cannot all be right." The 8-inch gun is not so long as the longest 32-pounder, it may be observed.

should quit the bore; but that there should be no superfluous length of gun which might produce unnecessary friction by the ball. What that length of gun may be has not yet, however, been ascertained with accuracy, although approximations to it may be collected from experiments already made, and from the experience of military men in actual warfare. In a fixed battery on shore the weight of ordnance is but of little importance, but in a vessel of war its effective force being in one respect limited by the *weight* of the gun it can carry, the *weight* of each piece of artillery, consequently in a great degree its length, is of great importance, and would well justify a series of experiments to ascertain this point.

Supposing experiment to be made on a 32-pounder of the greatest length that has been used, the bore of the piece should be made accurately true, shot should be provided exactly alike in shape and weight, and the gun and the shot should be perfectly free from dirt, rust, or scale.

Each experiment should be repeated at least five times, even when the results of all of them are alike, or very nearly alike; but where there might be any material difference of results, the number of experiments should be increased.

To ascertain the range of a gun of the same bore, but of different lengths, and with different charges of powder, load the gun with different charges of powder, each different charge being repeated at least five times.

The range of the gun at its full length being thus ascertained, reduce that length by two inches, and repeat the above indicated experiments. So continue to reduce the length of the gun by two inches at a time, repeating the same experiments with each length of gun.

Thus the most advantageous length of piece and of charge of powder would be determined.

Combined with the above experiments might be that of different forms and lengths of the chamber of a gun, but for this the piece must be prepared so that different chambers might be safely affixed to that part of the bore through which the ball has to pass. The conversion might be effected either in the same manner as bayonets are affixed, or rather in the way that the lids of cast-iron digesters are made to be connected or disconnected with the body of the digester.

Experiments on the chamber of the gun have already been made to a certain extent, but not so as to be conclusive either as to dimensions or form, on which depend the shape and size of the cartridge. It remains to be ascertained what length of cartridge in proportion to diameter is most favourable to the sudden ignition of the *whole* of the powder. What distance, if any, should be left between the cartridge and the shot? What part of the cartridge should be first ignited.

So also during the set of experiments as to length, the effect of a *diverging* prolongation of the bore might be ascertained. Mouth-pieces of different forms might be attached to the gun by either of the means proposed for affixing the chambers, the gun for these experiments being cast with suitable projections on its exterior. Thus would be determined whether the bore at the muzzle should terminate parallel, or expand tangent fashion.

4thly. As to thickness of the parts of a gun respectively proportioned to the strains respectively upon them. To determine in what proportion thickness of the piece should diminish towards the muzzle, and of what thickness it should be from the breech to the muzzle, have a piece of ordnance prepared of the length and form which, by the preceding experiments, has been found the most advantageous, but of the greatest thickness of metal that is ever employed: experiment on this piece, to ascertain the requisite thickness of parts of it by diminishing its thickness a very little at a time, and for very short lengths at once, and so successively along the whole length of the piece, firing off the gun with the full charge of powder and shot on each occasion that thickness of metal has been diminished; and so on till the piece bursts.

When the least thickness of metal that will resist the charge has been ascertained, it would, it is true, be proper to give an extra thickness for the sake of security; but although the degree of that extra thickness must necessarily be arbitrary, still it would be an arbritrariness grounded on accurate data. Guns for sea service should be proved with one

shot more than is permitted to be used in them.

Improvements desirable in regard to round shot are 1st. That they should fit more accurately, so as to diminish windage. 2ndly. That they should be less liable than at present to rust, and thereby continue of the proper size. 3rdly. That they should be heavier, so as to acquire more momentum with the same quantity of powder.

The consequence of windage is well known to be that of greatly diminishing the efficiency of a piece of ordnance, yet the amount of this mischief has neither been sufficiently ascertained nor guarded against. 1st. To ascertain the exact effect of it, shot might be prepared with means of giving three different diameters, as by a wrapping of lead or of woollen.

(*To be continued.*)

## QUEEN'S BENCH.

### 5*th June*, 1850.

#### THE QUEEN *v.* STOCKER AND BETTS.

This was a *scire facias* out, of Chancery, against the Defendants, Wm. Betts and Alex. Southwood Stocker, to repeal a patent granted to them jointly, 30th December, 1844, for their invention of "Improvements in bottles, jars, pots, and other similar vessels, and in the mode of manufacturing, stoppering, and covering the same."

Each of the Defendants appeared in pursuance of the writ, and the Defendant, Betts, pleaded in abatement the misjoinder of the Defendant, Stocker, who, it was alleged, had assigned all his interest in the patent to the Defendant Betts, and therefore ought not to have been made a party to the suit; and for this reason the Defendant, Betts, by his plea, prayed judgment if he should be compelled to answer the *scire facias.*

To this plea there was a demurrer on the part of the Crown; and the case having been removed into this Court for judgment, came on to be argued this day.

The Attorney-General and Mr. Hindmarch appeared for the Crown, and Mr. Webster appeared for the Defendant, Betts.

For the Crown, it was contended that the object of the *scire facias* was to repeal a patent granted to two persons, and as the Crown knew nothing of the assignments made by patentees, the only course to be adopted was to make each patentee a party, —that it was alleged in the writ that the Crown had been deceived in making the grant, and it was therefore necessary that each patentee should be a party, so that he might have an opportunity, if he pleased, either to answer the matters alleged in the writ, or to disclaim all interest in the patent. Several other objections to the plea were mentioned; upon which, however, it became unnecessary for the Court to give judgment.

For the Defendant it was admitted, that there was no precedent for such a plea; but it was contended that the making any person who has ceased to have any title to the patent a Defendant in the suit, might be productive of serious injury to the Defendant really entitled, and that the Crown having now notice of the assignment, ought to be compelled to sue out a fresh writ against him alone.

Several authorities having been cited on both sides,

The COURT, without hearing the Attorney-General in reply, gave judgment for the Crown; and said, that it being admitted that there was no precedent for such a plea, it was for the defendant to show it to be good in principle, which had not been done. That the Queen, having granted the patent upon the joint application of the two Defendants, had a right in such an action as this, which is brought for the benefit of the public, to call upon each of the Defendants to show cause why it should not be repealed.

The Defendant was ordered to answer the writ within eight days.

#### PHILLIPS'S FIRE ANNIHILATOR.

Sir,—I was much concerned to see, by a note in your last Number (page 436), that the Fire Annihilator Company have denounced the article in your 1397th Number as "*false,*" and therefore "unfairly prejudicial to their interests."

On making further inquiries, I am sorry to find that there are some inaccuracies in my former statement, which I regret exceedingly, as I would not willingly misrepresent anything. That the experiments which I described took place, and that the annihilator in each case proved *a failure*, are facts which I am prepared to authenticate if needful.

I was in error, however, in supposing that the experiments were conducted by Mr. Phillips; the fact being that the trials were made by purchasers of the Annihilators who were desirous of testing their capabilities for themselves.

The Company say (probably with much truth) that the fires kindled were much too large for the apparatus employed, a mistake into which the parties may have been led

by the "*overwhelming power*" ascribed to the Annihilators in the Company's prospectus.

I am, Sir, yours, &c.,
ANTI-COMBUSTIBLE.

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SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING MAY 30TH, 1850.

LOUIS NAPOLEON LEGRAS, formerly of Paris, but now 2, Tenison-street, Lambeth, C.E., Surrey. *For improvements in the separation and disinfection of fecal matters, in the manufacture of manure, and in the apparatus employed therein.* Patent dated November 30, 1849.

The improvements sought to be secured under this patent embrace :—

1. Several constructions of fixed and moveable water closets for effecting the separation of the solid from the liquid portions of fecal matters by opposing to their passage a series of curved surfaces, which are so arranged and combined that the tendency of the liquids to run down the curved surfaces, and of the solids to take a direct course, will cause them to separate, and be received into distinct vessels.

2. Various modes of constructing and combining a self-acting disinfecting liquid or powder case with fixed and moveable water closets, so that the closing or opening of the door or seat, or the depressing of a step, will cause a sufficient supply of the disinfecting agent to be discharged on the fecal substances almost contemporaneously with their deposit.

3. A peculiar construction and arrangement of apparatus in combination with a wagon for emptying the receivers of fecal matters of their contents and transporting them to any required distance in which the air-pump for creating the vacuum in the wagon, to exhaust the fecal matters into the latter, is worked by the rotation of the axle of the wagon itself. And also in combination with this wagon a peculiar construction of valve, through which the fecal matters pass, which has for its object to prevent the escape of any portion of them, and unpleasant smell.

4. Various disinfecting compounds.

5. The manufacture of a manure resembling guano in its fertilizing qualities, which is applicable to calcareous and alluvial soils, and which the patentee calls *urban guano.* It is composed of 200 lbs. of bestial dung; 100 lbs. of road scrapings, or street sweepings; 100 lbs. of marl; 100 lbs. of fecal substances; 100 lbs. of the residuum from the manufacture of schistus, or of peat, turf, or wood charcoal, ground to powder or of soot; 20 lbs. of marine salt; 15 lbs. of saltpetre; 10 lbs. of alumina; 5 lbs. of sulphate of zinc; and about 10 gallons of water. The whole is intimately mixed together, moulded into bricks, and dried; after which it is reduced to powder, and spread on the ground when it rains, at the rate of about 60 bushels, more or less, to about an acre, and ploughed in. When applied a second season, about half the former quantity is used; and if this be done for several successive years, an excellent arable land will be thereby obtained, which will afterwards not require manuring oftener than once every three years.

6. An arrangement and combination of apparatus for filtering sewage waters, in which the fecal matters are, at the same time disinfected and precipitated.

7. A construction of public urinary and refuse-water sink, in combination with an apparatus for discharging a liquid disinfecting agent, to prevent the accumulation of alkaline and fatty deposits.

8. A peculiar construction of lifting and forcing pump for transferring fecal matters from their receptacles to a wagon or cart.

*Claims.*—1. The separation of the liquids and solids of fecal substances by means of certain apparatuses; in so far as by such apparatuses both projecting and entering curves are presented to fecal matters in their passage from closets or drains to their receptacles, and whether said apparatuses are used in combination with water closets of any of the improved forms described, or adapted to others already constructed and in use.

2. The construction of water closets in the different modes described; that is to say, in so far as regards the arrangements for discharging determinate quantities of disinfecting powder or liquid on to the fecal matters, either in the pan of the water closet or in their receiver.

3. A peculiar construction of lifting and forcing pump, when applied to the transferring of fecal matters from their receiver to a removing cart or wagon.

4. The vacuum cart or wagon for the removal by exhaustion of fecal matters from their receptacle into an air-tight vessel or cart; in so far as regards the application of the rotary motion of the axle of one of the pairs of wheels to the working of the air-pump to produce such exhaustion.

5. The combination of the peculiar construction of air-pump with the improved vacuum cart.

6. A peculiar construction of valve.

7. The application of the residual mat-

ters (when carbonised) from the manufacture of schists into articles of commerce, and combined with any of the alkaline and saline bases, and absorbing materials, described under the fourth head.

8. The use of the various compounds described under the fourth head of this specification, for the disinfection of fecal matters, and other offensively smelling animal products.

9. The use and manufacture of the artificial manure, described under the fifth head of this specification, and which is termed "urban guano."

10. The apparatus for purifying and disinfecting sewage water, in the general arrangement and construction thereof.

11. The construction of public urinaries and waste-water sinks in the manner described.

George Edward Donisthorpe, Leeds, York, manufacturer. *For improvements in wheels of locomotive carriages.* Patent dated December 3, 1849.

The running surface of the driving wheel is composed of a number of independent blocks, which rest upon a ring of vulcanized India-rubber or other suitable elastic material. The blocks are supported by means of bolts attached to the inside of the flange, which take into slots in the sides of the blocks provided for that purpose, so as so allow them a certain amount of play.

*Claim.*—The manufacture of the driving wheels of locomotives with running surfaces, each composed of several separate and independent parts, whereby a greater amount of bearing surface is obtained.

Peter Fairbairn, Leeds, York, machinist, and John Hetherington, Manchester. *For certain improvements in machinery for preparing and spinning cotton, flax, and other fibrous substances.* Patent dated December 3, 1849.

These improvements relate principally to certain mechanical arrangements for giving variable speed to the spindles, in order that the yarn may be subjected to the same strain throughout; and also for compensating for the centrifugal force of pressers in flyers.

Baron James Ulric Strubing, Margaret-street, Cavendish-square. *For improvements in the manufacture of axletree-boxes for carriages, and of the bearings of the axles of railways, and in making of an alloy of metal suitable for such and like purposes.* Patent dated December 3, 1849.

This invention consists—

1. In pouring a melted soft metal through holes in the box, which, when cold, encircles the axle, and adheres firmly to the box. To provide for the admission of some lubricating substance to between the axle and the soft metal, a piece of cloth is previously twisted round a portion of the circumference of the axle, and under one of the holes in the box.

2. In certain apparatus for moulding the bearings of railway axles.

3. In the manufacture of the soft metal, which is composed of 75 parts, by weight, of zinc, 18 parts of tin, $4\frac{1}{2}$ of lead, and $2\frac{1}{2}$ of antimony. The zinc, tin, and lead are melted together, and the antimony, which has been previously melted at a higher temperature, is then poured in.

The claims embrace the improvements as described in the specification, and exemplified by the drawings which accompany it.

Conrad Montgomery, of the Army and Navy Club, St. James's-square, Middlesex, Esq. *For improvements in brewing, distilling, and rectifying.* Patent dated December 3, 1849.

*Claims.*—1. A method or process of preparing vegetable substances for the distillation of alcoholic spirit therefrom.

2. A method of distilling and rectifying, in so far as regards the arrangements for producing a constant circulation of cold water through and around the filtering materials.

3. A method of rectifying or purifying, in so far as regards the placing of the purifying or filtering materials in a close vessel, with porous bottom, and forcing the spirit through them by means of hydraulic pressure.

We shall give the details of this invention, with engravings, in a future Number.

George Buchanan, Edinburgh, civil engineer. *For improvements in cocks, valves, or stoppers, and in the use of flexible substances for regulating or stopping the passage of fluids, and also in making joints of tubes and pipes or other vessels.* Patent dated December 3, 1849.

The patentee describes and claims—

1. Several methods of interposing a membrane of vulcanised caoutchouc, or of other suitable elastic material, between the valves and their seats or other surfaces of cocks and valves, to insure a better contact than has hitherto been practicable.

2. Several constructions of self-regulating cocks, whereby the action of a float, which is produced by an increase of pressure either of steam, water, or other fluid, will cause the valve, which is furnished with an elastic membrane, as before, to close or open the passage, according to its peculiar arrangements.

3. A pressure gauge in which the fluid, the pressure whereof is to be ascertained, is made to act upon the exterior of a collapsible bag which is attached to the bottom of a vessel containing the indicating fluid, and

connected to a graduated glass tube, up which this fluid will be forced according to the amount of pressure acting upon the collapsible bag.

Joseph Paradis, Lyons, France, merchant. *For improvements in the manufacture of elastic mattrasses, cushions, and paddings, part of which improvements are applicable to other purposes where sudden or continuous pressure is required to be sustained or transmitted.* (Being a communication.) Patent dated December 3, 1849.

This invention consists in a peculiar construction of spring, which the patentee proposes to apply to the various purposes enumerated in the title of his patent. It is composed of a piece of wire, the ends of which are inserted loosely into the ends of a wooden cylinder, while a portion of the central part is coiled around the periphery of the latter, and the rest bent into two parallelograms—one on either side of the cylinder. The spring is placed between two surfaces, with the outer ends of the parallelograms attached thereto, so that when pressure is applied, these ends will approach towards each other, and the cylinder be pushed out.

*Claim.*—The peculiar form and construction of metal spring, and the employment of such spring, either singly or in pairs, or any mere modification thereof, for the purposes to which it or they may be applicable.

William Eccles, the elder, and William Eccles, the younger, of Blackburn, Lancashire, cotton spinners. *For certain improvements in machinery or apparatus for preparing, spinning, and weaving.* Patent dated December 3, 1849.

The patentees describe and claim:—

1. Dispensing with the ordinary mechanical arrangements for driving the bobbins in spinning machines, and substituting in their stead "fly-pressers," which, being in communication with the material to be spun, and in contact with the bobbins, impart the necessary rotary motion to the latter.

2. Relieving (in a great measure) the spindles from strain by supporting each of them in a step, formed on the top of a pin projecting from the bottom rail, on which the wharf revolves loosely. The spindle is provided at bottom with a clutch, free to slide up and down, which takes into a clutch box on the top of the wharf, whereby the rotary motion of the latter is communicated to the former. When it is desired to arrest the motion of the spindle, the clutch is made to slide upwards out of the clutch-box by the action of a forked lever.

3. An arrangement for driving bobbins somewhat similar to the preceding, with the exception that the wharves are keyed on tubes which slide over the spindles; and that the tubes and spindles are respectively furnished with feathers and grooves, whereby the copping motion will be communicated by the rotation of the parts themselves.

4. Making the flyers of some material of less specific gravity than metal, such as whalebone, bone, &c.

5. Dispensing with bobbins, and forming the cops on the bare spindles.

6. A peculiar construction and arrangement of throstle framės, in which the spindles are maintained in such positions that the lines through their centres shall be tangential to the lower delivering roller.

7. Certain mechanical arrangements for varying the angles of the spindles.

8. The employment of a peculiarly-shaped cam to cause the batten in looms to beat up twice at each revolution of the main shaft.

9. The employment of one cam, in combination with two conical rollers, and a system of levers to effect the two picking motions.

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*Specification Due, but not Enrolled.*

Walter Crum, Thornliebank, Renfrewshire, N.B. *For certain improvements in the finishing of woven fabrics.* Patent dated December 3, 1849.

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WEEKLY LIST OF NEW ENGLISH PATENTS.

Thomas Page, of Middle Scotland-yard, Middlesex, civil engineer, for improvements in the construction and means of cleansing sewers. June 1; six months.

Ezra Jenks Coates, of Bread-street, Cheapside, London, merchant, for improvements in the manufacture of bolts, spikes, and nails. June 1; six months.

Moses Poole, of the Patent Bill Office, London, gentleman, for improvements in machinery for punching metals, and in the construction of springs for carriages and other uses. June 1; six months.

Arthur Elliott, machine maker, of Manchester, and Henry Heys, of the same place, book-keeper, for certain improvements in machinery for manufacturing woven fabrics. June 1; six months.

Guillaume Ferdinand de Douhet, of Clermont Ferrand, France, gentleman, for improvements in the disoxygenation of certain bodies, and the application, separately or simultaneously, of the products therefrom to various useful purposes. June 1; six months.

Frank Clarke Hills and George Hills, of Deptford, Kent, manufacturing chemists, for certain improvements in manufacturing and refining sugar. June 1; six months.

Samuel Brown, of Lambeth, Surrey, engineer, for improvements in engines for measuring and registering the flow of fluids and substances in a fluid state, which improvements are also applicable to steam and other motive engines. June 1; six months.

John Tucker, of the Royal Dockyard, Woolwich, Kent, shipwright, for improvements in steam boilers, and in gearing, cleansing, and propelling vessels. (Being a communication.) June 1; six months

George Hayward Ford, of St. Martin's-le-Grand,

Middlesex, gentleman, for improvements in obtaining power. June 3; six months.

Paul d'Angely, of Paris, France, gentleman, for certain improvements in the construction of privies and urinals, and in apparatus and machinery for cleansing privies, cesspools, and other places, and in deodorizing the matter extracted therefrom, and rendering it available for agricultural purposes. June 4; six months.

David Napier and James Murdock Napier, of the York-road, Lambeth, Surrey, engineers, for their invention of improvements in apparatus for separating fluid from other matters. June 4; six months.

Theodore Cartali, of Manchester, merchant, for certain improvements in the treatment or preparation of yarns, or threads, for weaving. (A communication.) June 4; six months.

William Watson, the younger, of Chapel Allerton, York, manufacturing chemist, for improvements in the preparation and manufacture of various materials to be used in the processes of dyeing, printing, and colouring. June 4; six months.

John Sykes and Adam Ogden, both of Dock-street, Huddersfield, York, wool cleaners and machine makers, for certain improvements in machinery for cleaning wool, cotton, and similar fibrous substances from burrs, motes, and other extraneous matter. June 4; six months.

Edmund Sharpe, of Lancaster, master of arts, for certain improvements in railway carriages. June 5; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements applicable to boots, shoes, and other coverings for, or appliances to, the feet. (A communication.) July 6; six months.

George Jackson, of Belfast, Ireland, flax spinner, for improvements in heckling machinery. June 6; six months.

John McNicoll, of Liverpool, engineer, for improvements in machinery for raising and conveying weights. June 6; six months.

William Robertson, of Gateside-hill, Neilstone, Renfrew, Scotland, machine maker, for improvements in certain machinery used for spinning and doubling cotton, and other fibrous substances. June 6; six months.

James Alexander Hamilton Bell, New York, America, merchant, for improvements in dressing bran, pollard, and sharps. (A communication.) June 6; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| May 30 | 2314 | Francis West | Fleet-street and Strand | Radius rule. |
| " | 2315 | William Pope & Son | Edgeware-road | Stop valves for the admission of hot and cold water for bath and wash-house purposes. |
| " | 2316 | John Roe | West Bromwich | Lock. |
| 31 | 2317 | John Marvin | London Gas Works, Vauxhall | Portable smelting apparatus. |
| " | 2318 | John Heather | Bedford-court, Covent-garden | Blackwell's razor guard. |
| " | 2319 | Emanuel Bailey Mather | Oxford-road, Manchester | Drag with moveable body. |
| " | 2320 | Joseph Fenn | Newgate-street | Cymameter. |
| June 3 | 2321 | William Peter Piggott | Oxford-street | Galvanic belt. |
| " | 2322 | John Hill | Jermyn-street | The Choretikopas, a portmanteau on a new construction. |
| 4 | 2323 | William John Normanville | Queen's-road, Regent's Park | Elastic attachment for the side chains of railway carriages, wagons, &c. |
| " | 2324 | George Godsell | Regent-street | Jupon chemise. |
| " | 2325 | George Ingram | West Bank, Portobello | Socket joint for street and other drains. |
| 5 | 2326 | John Bessell | 7, Farringdon-street, London | The invisible ventilator. |
| " | 2327 | Robert Calvert, M.D. | Camden-street North, Camden New Town | Self-adjusting brace. |

## NOTICES TO CORRESPONDENTS.

Dr. Radford *will oblige a correspondent, who is anxious to communicate with him relative to his experiments in magneto-electricity, by forwarding us his address.*

Mr. W. Mansfield, *the inventor of the Benzole Light, is also requested to favour us with his address.*

## CONTENTS OF THIS NUMBER.



LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1401.] SATURDAY, JUNE 15, 1850. [Price 3d., Stamped, 4d.

Edited by J. C. Robertson, 166, Fleet-street.


## LO PRESTI'S PATENT HYDRAULIC PRESSES.

Fig. 1.

## LO PRESTI'S PATENT HYDRAULIC PRESSES.

(Patent dated December 10, 1849. Patentee Baron Louis Lo Presti. Specification enrolled June 10, 1850.)

### *Specification.*

Hydraulic presses are constructed on the principle that if pressure is applied to any portion of the surface of a liquid contained in a water-tight vessel, that pressure will be repeated on the sides of the vessel as often as the portion of the surface of the liquid to which pressure was first applied is contained in the sum of the surfaces of the sides. They commonly consist of a large cylinder fitted with a piston or ram, and of a small lifting and forcing pump, which is in communication with the cylinder, and supplies it with water or other liquid; and as this pump is worked with a lever, great pressure is exerted on its piston or plunger, which produces on the ram a power equal to the pressure applied to the plunger of the pump, multiplied by the ratio which the surface of the plunger bears to that of the ram. Now it follows from these premises, that the greater the difference between these surfaces the greater will be the amount of pressure obtained. This pressure is applied to the compression of substances by placing them between the head of the ram and a fixed plate, which is suitably attached to the cylinder by iron bolts. If, for example, one pump only were employed, the ram of the cylinder would be moved forward according to the quantity of water furnished by the pump, and would therefore act at one uniform degree of pressure from the commencement to the end of the operation; but inasmuch as the substances to be pressed offer generally less resistance at the commencement than at the end, let us suppose two pumps of different capacities used, the larger to be at the beginning, to move the ram more rapidly by the introduction of a larger quantity of liquid, and the smaller towards the end of the operation, in order to impart a greater force to the ram: Then it is evident that by employing a series of pumps of different capacities, we should be able to communicate to the ram a rapidity of motion in inverse proportion to the resistance of the substances to be compressed; that is to say, it will travel fast at the commencement of its rise, and gradually diminish in speed towards the end, when its movement will be very slow in consequence of the smallest pump being employed. But the use of a series of pumps would be a matter of great expense, especially for hydraulic presses employed to compress soft matter, such as hay or cotton; and in practice seldom more than two pumps are used whereby considerable time is lost. Now the object of my invention is to remedy that defect—

*Firstly.* By substituting for a series of pumps a combination of machinery which shall produce the same results and not be of expensive construction. For this purpose I have invented the several methods, now to be described, of effecting the said combination; preferring, nevertheless, the first of these because of the superior simplicity of its construction and its capability of being adapted to presses already in use at little cost. My invention may be said to be based on the principle, that the result of a force employed to overcome a certain amount of resistance, multiplied by the speed thereof, *id est* the distance travelled in a unit of time, is always equal to the resisting force multiplied by its speed; from which principle I deduce as a corollary, that the resistance to the small plunger being feeble at commencement, and becoming stronger by degrees as the substances are compressed, I therefore give more strokes of the plunger at the commencement—diminishing them gradually until the end of the operation, yet cause the ram of the cylinder to travel faster at the beginning than at the conclusion.

Fig. 1 (an exterior elevation) and fig. 2 (a plan) represent my first improvements in hydraulic presses to be worked by hand-power; and figs. 3 and 4 are detached views, on an enlarged scale, of some of the parts thereof. A is the barrel of the pump; B the plunger, which is attached to about the centre of the piston-rod *c*, which passes through the two stuffing boxes, DD, fixed to the valve boxes E E.

These valve boxes are attached to the top and bottom of the barrel of the pump, to enable the piston A to force water at each up and down stroke into the cylinder K, underneath the ram I, through the pipes F F, which are united as indicated in

fig. 1. H is a reservoir of water, containing a sufficient quantity to drive the ram to the full extent of its course. The water flows through the pipes J J into the top and bottom valve boxes E E, and is forced into the cylinder K by the action of the plunger B. The reservoir H is supported on a table L, a little above the upper valve box E. The piston rod C is connected by links O O to the cords P P, which pass over two pulleys M M, the lower one of which is fixed to the ground, and the upper one supported in the top of a frame N. The other ends of the cords P P are attached separately to two escapement wheels Q Q, which are keyed upon the same axle. To prevent the cords from twisting, they are divided at about the centre, and subsequently united by the shackles R R. Between the escapement wheels Q Q there is keyed upon the same axle a toothed wheel S, which receives rotary motion from another toothed wheel T of the same diameter. One end of the axle of the wheel T is squared to receive the crank U

Fig. 8. Fig. 9. Fig. 13.

14.

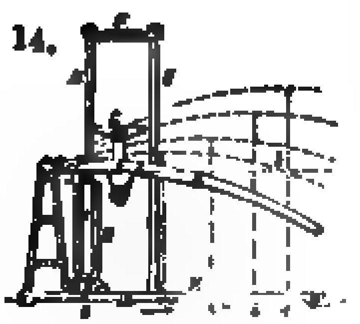


Fig. 5.

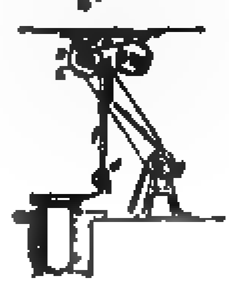
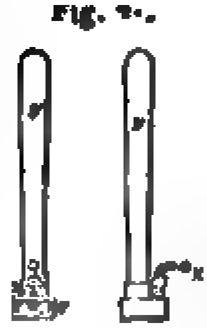


Fig.



7.

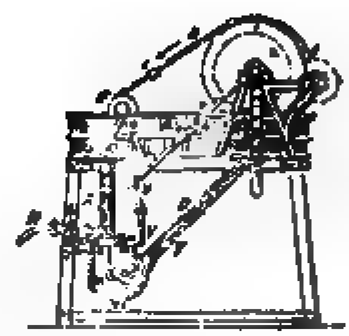


Fig. 3.

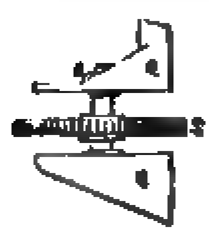


Fig. 12.

Fig. 10.

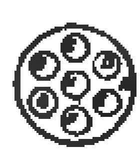


Fig. 6.

which carries the sliding handle V, which may be fixed at pleasure by means of the catch $x$, acted on by the spring $y$ (shown on an enlarged scale in fig. 6) in any one of the positions indicated by the holes 1, 2, 3, and 4 in the crank V, fig. 1. The catch which takes into one of these holes, and is kept in position by the spring, has to be bent back to withdraw it, and to allow of the position of the handle being changed for the purpose of increasing or diminishing the leverage as required. A pinion $a$ is supported in the frame Z, which carries the two toothed wheels S, T, and gears into the latter (T). One end of

the axle of the pinion is also made square, and of the same size as that of the axle of the toothed wheel T, to receive the handle when the pressure reaches a certain limit, for the purpose of increasing the power, in order to carry it beyond that point.

To begin working, the reservoir is, once for all, filled with water, and the crank placed on the axle of the wheel T; the handle is fixed in the hole No. 1, as shown in the figures, and rotary motion communicated to it, whereby the wheel T will be made to revolve, as well also as the wheel S, which will cause the escapement wheels or pulleys Q Q to rotate —the one winding up its cord on the projecting part (shown on an enlarged scale in fig. 3), and the cord of the other escapement wheel hanging loose. The cord, which is being wound up, will move the plunger B, and eject the water, as in the ordinary pump, until the cord reaches the extremity of the projection at the point *b*, when it will slide off and unrol itself. At this moment the other escapement wheel or pulley, which has accomplished half of a revolution, begins to wind on its cord, whereby the piston will be moved in the reverse direction, and the projecting portion being the same in this instance as in the preceding, the cord will at a certain point slide off, and be unrolled. By substituting these escapement wheels or pulleys for two cranks or eccentrics, which might have been employed, an advantage is gained, because the distance travelled in one revolution of the pulleys is equal to the diameter thereof, which produces two strokes of the plunger; while, by using cranks or eccentrics, with the same leverage, twice the diameter only would be travelled over.

Figs. 5 and 6 represent part of a hydraulic press to be worked by a steam engine or other prime mover, constructed according to my invention. A is the main driving shaft, on which is keyed the conical pulley *b*. C is a second conical pulley keyed on the shaft *d*, which is opposite to the apex of the cone *b*. A driving band *h* passes round the two pulleys *e* and *f*, and communicates the motion derived from the prime mover to the pulley keyed upon the shaft *d*, which, in turn, imparts rotary motion to the pulley *f*, of the same diameter as the pulley *e*. The pulley *f* is mounted on the shaft, at the ends of which are keyed the escapement wheels *g g*. I is a lever (attached to the cord T, which passes over a pulley, and is connected to the ram), which causes the driving band H to slide along the conical pulleys *b c*. The reciprocating motion is communicated from the escapement wheels *g g* to the plunger, as in the hydraulic press before described.

Fig. 7 is a longitudinal elevation, partly in section, of an apparatus for injecting a continuous stream of water into a hydraulic press, instead of the arrangement which has just been described. A is the barrel of the pump, fixed at top to the under part of the water reservoir B. A number of pistons, *c c c c*, working in the barrel A, are fixed at equal and determinate distances upon the endless cord D, which passes over a pulley E (supported on standards F, attached to the reservoir B), down the barrel A, and under a second pulley G (centred in a box H, affixed to the lower part of the barrel A), then up the pipe Y (opening into the box H, at bottom, and the reservoir B, at top), and last over the driving-pulley I. The axle M, of the driving-pulley I, turns in bearings in the frames JJ, and has keyed upon it a toothed wheel K, into which gears a pinion L, keyed on a second shaft N, also supported in bearings in the frames JJ. Two valves, OO, faced with caoutchouc or other suitable material, turn on pivots, are made close to the end of the barrel by pressing tightly against it. These valves have two semicircular holes cut in the opposite sides, to admit of the passage of the endless band D between them. On motion being communicated to the pulley I, by means of the handle P, the endless band D will travel in the direction of the arrow, and the piston *c*, which enters the barrel A, will compress between it and the valves OO, the water that shall have previously flowed therein from the reservoir B, and cause it to open the valve Q, when it will be forced through the pipe R into the press; on the piston *c* arriving close to the valves, OO, the eccentric S, keyed on the axle M, will push the rod T, which will act on the levers UU, so as to move the rods VV in the reverse direction, and allow the valves OO to fall down, to admit of the passage of the piston between them. When the piston has passed the valves, the eccentric will cease to act upon the rod T, which will be pushed back by the spring X, so as to bring the valves OO into their first positions, and close the barrel A. A portion of water will be carried with the piston into the box or case H, and into the pipe Y, which communicates with the water-reservoir B. The shaft M is fitted with a sliding handle (as in the apparatus before described), whereby four different degrees of velocity can be imparted to it; after which the handle may be placed on the shaft N, and through the intervention of the pinion L, four fresh degrees of velocity be communicated to the main driving pulley. Another arrangement for communicating the to-and-fro movement to the plunger, consists of two toothed wheels which gear into one another, and have keyed on their respective spindles two other wheels, having teeth in portions only of their peripheries. A toothed rack is fixed to the top of the plunger, into which gear respectively

the partially toothed wheels, whereby the necessary to-and-fro motion will be communicated to the plunger on one of the toothed wheels being made to rotate by having a handle similar to the one before described.

*Secondly*. My invention consists of a method of constructing the rams of hydraulic presses, whereby I am enabled to obtain different degrees of velocity. Fig. 8 is a sectional elevation of a ram constructed of five different diameters. A is a pipe, which conducts the water from the pump to beneath the surface B of the part No. 1, which is the smallest in diameter. As soon as the water is forced in, the ram will ascend rapidly in consequence of the small volume of water required to displace it. The power obtained will be in the ratio of the surface B to that of the plunger of the pump multiplied by the power communicated by the lever from the workman to the plunger. As soon as the portion No. 1 passes beyond the first joint, the water will act upon the surface C of the division No. 2 of the ram, as well as upon the surface B. The ram will then ascend less rapidly than before, but will give out an increased degree of pressure; and so on throughout the series 3, 4, 5—the water acting upon their surfaces successively, whereby the speed of the ram will be progressively decreased, and its pressure increased. When it is desired to exert the whole pressure at the beginning, water is forced in through the pipes D and A, which open into one another at a point of junction (as shown in the figures), and communicate by means of the cocks E F. When the operation is terminated, the water is drawn off by the pipes G and H, by opening the cock I and a valve placed on the pipe H, as in the ordinary hydraulic press. The water compressed by the intermediate portions of the ram 2, 3, and 4 passes by the channels *a*, *b*, *c*, and returns into the large one, whence it escapes by the pipe H.

Fig. 9 is a sectional elevation of another mode of constructing a hydraulic ram for obtaining the same object; namely, variable degrees of speed and pressure. A is the ram, pierced with (say) seven holes, to which are adjusted as many hollow stoppers B, C, D, E, F, G, H, shown in fig. 10 (a plan), of different lengths, fixed underneath the cylinder, which they close completely. These stoppers are supported in the box I attached to the bottom of the cylinder, and carry at top valves *b*, *c*, *d*, *e*, *f*, *g*, *h*, which open upwards. Water is forced into the cylinder as before, through the pipe K, and acts upon the lower surface of the ram, which encircles the stoppers, whereby it will be raised, and the shortest stopper B withdrawn. In this case, the surface of the ram will be augmented by that of the stopper, and will consequently move upwards with a greater force, but at a less rate of speed. As the water is pumped in, the ram continues to ascend, whereby the stoppers will be successively withdrawn from their respective chambers; the effect of this will be to successively increase the power and decrease the speed of the ram. As the ram ascends and the stoppers are withdrawn, a partial vacuum is created in their respective chambers (within the ram), into which the valves will open and allow the water to flow in through the hollow stoppers from the pipe L, which communicates with a reservoir of water. When the substances have been sufficiently compressed, and it is desired to bring the ram down into its first position, the screw M is turned by hand or other power, whereby the plate N (a plan of which is given separately in fig. 12) will be pushed up, which will have the effect of forcing the rods, 1, 2, 3, 4, 5, 6, and 7 (fig. 11), up the hollow stoppers within which they are respectively placed. The ascent of these rods will force open the valves, *b*, *c*, *d*, *e*, *f*, *g*, *h*, in the upper part of the stoppers, and allow the water which was contained above them within the hollows of the ram, to flow out, which otherwise would be compressed by the stoppers in the hollows when the ram descended.

Fig. 13 represents another mode of constructing the ram of a hydraulic press for the purpose of imparting to it a velocity proportionate to the resistance offered by the matters to be compressed. A is the ram with a central longitudinal hollow B, within which is placed the fixed stock or stopper, C. The stopper is packed water-tight by the collar D, beyond which the hollow in the ram is increased in diameter, and that portion of its external periphery is cut away so as to diminish the thickness of the sides E E, which take into a groove cut for them in the bottom of the cylinder. Water is forced in by the tube G, which acting against the surface H H of the ram, forces it up until the sides E E are withdrawn from them: the water will act, in addition, upon the surfaces I I and J J, and raise up the ram above the stopper C, when the whole surface thereof will be acted on by the pressure of the water. By this arrangement three degrees of velocity are obtained by using one pump, and six degrees by using two pumps. The pipe K, a portion of which is made of leather or other flexible waterproof material, is fitted with a valve L, and conducts water into the hollow of the ram A, above the stopper C, to allow of the descent of the former when the operation is completed. N is a pipe opening into the lower part of the cylinder, and also furnished with a valve to allow the escape of water from the interior, as it is compressed by the descent of the sides E E of the ram.

Fig. 14 is a cross section representing the application of a hydraulic press, constructed according to my invention, to the working of a lever. The object of this apparatus is to compress the substances to be operated on more rapidly when it offers less resistance, and consists in a standard A, to the top of which is hinged the curved lever B. This lever communicates its upward motion to the plate C by means of the connecting rods D D, which are loosely riveted to either side of the cross-head I I, attached to the lever, and to the sides of the plates C. Or, the rising motion may be communicated by means of a roller to the plate C, which is guided between four uprights, E, E, E, E, which are fixed at top to the under surface of the head plate F, and at bottom in the foundation. The substances to be compressed are placed between the two plates C and F, and water is forced into the cylinder H in the ordinary manner. The head of the ram I is furnished with a roller J, having a groove cut on its circumference, into which fits the lever B. The cylinder of the press is mounted upon wheels, to allow of its moving to and fro upon the rails fixed to the floor. The injection-pipe should be made telescopic, to allow of this reciprocating motion. Water is first pumped into the press when it is at the point O, whereby the ram in its ascent will raise up the lever B, and consequently the plate C. As the water is pumped in, the press seeks to adapt itself to the curve of the lever, and therefore slides forward in the direction of the arrow, into the position marked 1 (fig. 8), when the ram has arrived at one-fourth of its journey. When the ram has reached the half, the press slides into position 2; when the three-fourths, into position 3; and when the end, into position 4. It will be seen from what has been said that the ram began to act with a degree of pressure less than it was capable of applying direct, on account of its acting on the lever, between the fulcrum and the point whence the pressure is given off; and that the amount of pressure obtained gradually increases the further the press travels from the fulcrum of the lever, until it reaches the position 4, when the resulting power is three times the normal power of the press; because the distance $a\ b$ is three times the distance $a\ c$. When the operation is completed, the cylinder is emptied in the ordinary manner, and the ram brought down. The lever also falling, forces the press back into the first position O.

In order that the hydraulic presses constructed according to my invention may be expeditiously worked, I recommend that the inflow and outflow pipes should be constructed of a large diameter. Having now described the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim as constituting my said invention is as follows:

*Claims.*—1. The general arrangement, combination, and adaptation of parts described under the first head of this specification for forcing water or other liquid into the cylinder of a hydraulic press in a continuous stream, and for effecting the rise of the ram at a diminishing rate of speed, with an increasing amount of pressure according as the substances are compressed.

2. The arrangement and combination of the conical rollers combined with the apparatus first before claimed, for communicating the requisite motion from a steam engine or other prime mover to the axes of the escapement wheels.

3. The general arrangement and combination of parts for forcing into a hydraulic press water in a continuous stream.

4. The various modes of constructing the rams of hydraulic presses, in order that the same may rise at a decreasing rate of speed with an increasing amount of pressure in proportion as the resistance of the substances to be operated on increases.

5. The use of a lever arranged and combined with the ram and pressure plate.

6. Causing the rams of hydraulic presses to move at variable rates of speed by means of the arrangements before described, or by any mere modifications thereof.

## SUGGESTIONS FOR THE IMPROVEMENT OF NAVAL GUNNERY. BY THE LATE BRIG.-GEN. SIR SAMUEL BENTHAM.

(Concluded from page 456.)

The mischievous consequences of rust are so great, as perhaps to justify the coating of shot with some pigment or cheap substance that would protect it from wet and from the atmosphere. 3rdly. Increase of weight, so far as is known, can only be given to shot by the use of a metal of greater specific gravity than iron, and a consequent great increase of cost. But it would be well worth while to ascertain what variety of cast iron is of the greatest specific gravity, so that shot might always be required to be of that variety.

But in regard to shot, experiments are wanting to ascertain a most important

point,—that of the best form for passing through the air, as also for penetrating a vessel's side.

The continuance of the flight of the shot through the air, in the direction given to it at the instant of projection, will depend on the position of its centre of gravity, and on its form as giving rise to a modification of its direction caused by the resistance of the air as well as by gravitation; circumstances which cannot but be much influenced by the form of the shot, as whether globular, cylindrical, oblong, or ovoid.

Sir Howard Douglas has shown that shot, of an ovoid form, pass more readily through the air than those that are globular; but his experiments do not seem to have been carried to an extent sufficient to ascertain the *exact* form of shot which would be the most advantageous: various other forms have at different times been proposed, and several experiments have been made, but none of them in any respect exhaustive. Experiments are therefore still required to ascertain the best form of shot as regards the two several points—of facility of passage through the air, and of penetration into or through a ship's side; particulars capable of being determined by the same set of experiments.

Diameter and form of shot being given, it would then have to be ascertained; 1stly, What proportion will increase of range and destructibility bear to increase of weight? and, 2ndly, What difference in these respects between solid and hollow shot?

But the efficiency of shot is not confined to these particulars; there is the farther question of, what is the most advantageous form and description of shot for *different* purposes?

Is the object aimed at percussion—as the battering a fortress? Is it simple penetration, as the piercing a hole in a ship's hull? Is it laceration, as splintering a ship's side, or tearing her sails? Is it to cut, as the rigging of a ship? Is it to burn, as the ship itself, her rigging, or her sails? Is it to blow up, as by firing a powder magazine? Or is it to spread destruction amongst a ship's crew?

It must have been with a view to effecting these several purposes, that so great a variety of shot has been introduced in addition to simple round shot; so it must be a strict investigation of the peculiarities of the several varieties of shot, that must lead to a well-grounded decision of the preference to be given, as the case may be, to one description of shot or to another.

If battering be the object, the inquiry should be, what size, what weight and form of shot has been proved by particular experiment, or inferred from general experiense, to be most efficient in breaking up hard masses—such as walls of stone, &c.; and where neither experiment nor experience afford convincing proof, farther experiment should be instituted: and so in respect to all the other points of inquiry.

If for penetration into less hard and semi-elastic matter, as the side of a vessel, what is the weight of shot that can penetrate the side of the largest ship? What the form that enters wood most easily? What the form and the *velocity* that leaves the largest aperture?

If for laceration, what is the form and kind of shot that most splinters wood, or tears outstretched surfaces like sails? And so on, in regard to the several other purposes of destruction for which shot are destined in actual warfare.

Another question, which has not yet been ascertained in regard to the destructiveness of shot in naval warfare, is, whether a given weight of metal be most efficacious when in a solid mass, or when more or less extended in size by being made hollow?

It is of the first importance to ascertain the size of shot best suited to combating the largest vessel likely to be met with, and at the distance where there is the greatest probability of taking aim with the least chance of injury from the enemy's shot. This size determined on, whether such shot be a 32-pounder, a 42-pounder, or of any greater weight, it seems essential to efficiency that all vessels of war should, in as far as possible, be capable of throwing shot of that efficient description. And besides such heavy shot, the vessel should also be furnished with lighter shot of the same size, as also with smaller shot; both of these descriptions of shot for the purpose of being fired from the same gun whenever either of them may be more suitable than the heavy large shot, on account of the smallness or nearness of the object to be attained.

It is well known that an equal weight of small shot can be thrown from the same gun that is competent to throw a single shot of a given weight; and it must not be forgotten that even when the purpose is to destroy sails, rigging, boats, or men, that a dozen shots of four pounds, each thrown from a single gun, will, with less trouble, have as good a chance of efficacy as if the twelve shots were fired from twelve guns suited to throw shot only of that small size; to say nothing of the spreading other kinds of shot applicable to these purposes,* and which can be so much better thrown from a large than from a small piece of ordnance.

Also, it should be ascertained what the *least* weight of shot is that can be propelled with good effect from guns of large calibre, since, when the object to be attained is at no great distance, a lesser weight of shot might often suffice; thus saving cost in the shot itself and still more in powder, as a less quantity of it would be required.

The great variety of modes in which guns have been mounted, indicates that the different carriages have been devised more with a view to obtain some particular advantage, than with a general reference to the several and very different requisites in this important adjunct to a piece of ordnance. The principal desiderata in the mode of mounting guns are—1st, That the carriage shall be affixed to that part of a vessel best suited to resist the reaction of the gun during the impulse given to the shot; 2nd, That the mode of connection shall be so strong in all its parts as that the gun itself shall be near to its bursting point before its connection with the ship should give way; 3rd, That the gun, at the time of firing, shall rest its weight upon a very broad bearing on the deck, so that the planks of the deck shall not be liable to injury from the trucks or rollers, and that no motion of the ship in bad weather shall be sufficient to move the gun in any direction out of the position in which it has been purposely placed, and this without any lashing or other operation being necessary to hold it fast; 4th, That the extent to which a gun can be trained forward or aft be as great as possible, and that the force of one man shall suffice to train it; 5th, That when it is required to point the gun forward or aft, by the application of a handspike, the weight of the gun and carriage shall be transferred instantaneously from the broad bearing on which it rests, on to rollers, so placed as that it shall be easily trained forward or aft, and that, on letting go the handspike, the effect of the rollers shall instantly cease, and the gun remain steadily fixed by its own weight in the position to which it has been brought; 6th, That the elevation or depression of the gun be sufficient to admit of its being fired point blank, or to an elevation of five degrees from a horizontal line, and this whatever be the inclination of the ship itself, or whether the gun be on the windward or leeward side of a ship; 7th, That the means used for supporting the breech of the gun, so as to place it at the proper elevation or depression for firing, shall hold it *down* as well as up, and so that the firing shall not alter the position of it; 8th, That after the recoil of the gun, the means of replacing it should require the least possible exertion, consequently the fewest number of men; 9th, That the materials of which the carriage is composed should be suited to resist deterioration from alternate wetness and dryness, or other chemical causes of destruction, as well as the reiterated shocks to which it is exposed as often as it is applied to use.

Commanders of vessels have frequently in time of action had their ordnance *lashed* to the vessel's side, to make the piece carry further: recoil of the gun has been thus prevented, but it has never been ascertained in what degree the range of the piece has been increased by prevention of recoil, either wholly or only partially. Experiments to determine this important point would be very simple; nothing more would be necessary than to have a piece of ordnance fixed on a carriage, with a breeching which admitted of the greatest degree of recoil, that breeching being affixed to the vessel's side. In making the experiments, the piece should first be fired so as to allow the greatest recoil to take place, and the distance marked to which

* At page 719 of the Report of the Select Committee, 1848, is an "Account of the Ordnance Stores of every description furnished for an 80-Gun Ship;" shot, and shells, and Congreve rockets, are set down in it, but no mention is made of shot of any of the many descriptions that are known to be eminently destructive to sails, rigging, &c., as chain, case, grape shot, &c.

the shot is carried; next, the breeching should be shortened (say) six inches, thus checking the recoil, then firing again the piece, and marking again the distance to which the shot is carried; and so to continue shortening the breeching by six inches at a time, and repeating the experiments until the recoil of the piece should be entirely prevented.

It would be proper that this series of experiments should be made both from a fixed battery on shore and on board of a vessel afloat, in order to ascertain the effect the yielding of the vessel might have either on the range of the shot or the strength of material requisite for a gun-carriage, &c., in the several cases, when recoil might be permitted, checked, or wholly prevented.

## DISCUSSION ON RAILWAY AXLES, AND ON THE STRUCTURAL CHANGES WHICH IRON IS SUPPOSED TO UNDERGO FROM VIBRATION AND CONCUSSION.

(Continued from page 436.)

The CHAIRMAN observed, that according to the experiments made by Professor Barlow, the permanent stretching began at 8 or 10 tons per inch, and the bar never came back again to its original length after that limit of strain was passed. It must be borne in mind that the section of the bar was diminishing, and its density increasing during the stretching.

Mr. WALKER observed, that in some experiments he had tried, it was found that 28 tons per inch was the ultimate pressure borne by bar iron, and in some cases it went up as high as 32 tons before breaking, but in these cases the weights had been applied very quickly.

The CHAIRMAN concurred in the opinion that time was a very important element in experiments of this nature.

Mr. SLATE observed, that the same remark was applicable to cast iron.

Mr. COWPER believed that the point at which the elasticity of iron was overcome and permanent stretching commenced, might be measured at 8 tons per square inch, or by a fine micrometer, at 7½ tons; although by measuring more roughly with beam compasses, it had been stated so high as 10 tons. A bar 3⅜ inch square and 7 feet 6 inches long, bore 27 tons per square inch before it broke, and it was then extended in length 5 inches; the elasticity of that bar, after being permanently extended upwards of 3 inches, was as nearly as possible the same as it was at first, before permanent extension had commenced; it was stretched one-eighth of an inch by the same increase of strain in both cases, and returned completely.

Mr. SLATE doubted the accuracy of this principle.

The CHAIRMAN observed, that Mr. Cowper meant, that although the iron was permanently extended, the cohesion among the particles was not so altered as to interfere with the law of its elasticity. The iron itself was not crippled, though the area might be altered; hence the law of elasticity was not altered, and the constitution of the iron itself was not deteriorated.

Mr. ROBINSON said, he considered there was an advantage in making experiments with the hydraulic press, because it afforded a good means of detecting the stretching—immediately that extension took place the pump handle began to move faster. It was found in practice, that the moment they got beyond the elastic strain in a bar of iron, it became deteriorated; and they never considered it capable of bearing again with safety unless it came back to the starting point.

The CHAIRMAN did not mean to speak with disapprobation respecting the pump, but he thought a little want of accuracy might be created by the use of it, for he thought it quite clear that some better means than the pump handle might be devised, and was in fact in daily use for ascertaining the extension of the iron. Even a little leakage, or an extension of the bar, would detract from the accuracy of the experiment; and in the complicated pump apparatus there was a great deal of friction, sometimes requiring an additional half ton per inch to move the ram alone, as had been sometimes observed at the Britannia Bridge. The pump might be out of order, and hence it was a matter of importance to use that mode of testing which was not liable to go wrong, although the use of the dead weight might be the most troublesome.

Mr. ROBINSON said, he thought no bar was capable of enduring more than 14 or 15 tons per inch, but it was easy to explain the reason why some had stated the results of experiments to range as low as 8 or 9 tons. The accuracy of all such experiments depended on keeping the line of strain in the axis of the bar, and in proportion to negligence in this particular would they fail in obtaining the true results. At the same time he thought it necessary that further experiments should be conducted on as accurate a scale as possible before they attempted to decide a point of such importance.

The CHAIRMAN observed, that some ex-

periments had been made by Mr. Parkes, with iron bars, about 3 feet long and 1¼ inch square. In order to discover the ultimate strength of wrought iron, he put weights upon the centre of the bars; but the deflection was so great that they bent down between the supports, and the experiment was spoiled. Accordingly he adopted this ingenious mode of ascertaining the point; he took two bars perfectly similar, heated them in a furnace, and allowed one to cool in a straight position; the other was bent hot into a curve of 5 inches in 3 feet, and then allowed to cool in that form. When both bars were cold, he commenced experimenting with the plain straight bar, and that bent very readily. But before he began to experiment on the bent bar he straightened it cold, and by so doing he brought the particles of the under side of the bar into a state of tension, or in other words into the condition of a tension bar, and the bar broke with very little deflection, because the strain was like that on a trussed girder with a tie rod.

(*To be Concluded in our next.*)

## CHESTERMAN'S PATENT CARPENTERS' AND ENGINEERS' BRACES AND BORING TOOLS.

(Patent dated November 13, 1849. Patentee, James Chesterman, of the firm of Cutts, Chesterman, and Bedington, of Sheffield, machinists. Specification enrolled May 13, 1850.)

### *Braces.*

Fig. 1 is an elevation, and fig. 2 a longitudinal section of one improved instrument of this description. A is a spindle or stem. The power employed to give motion to the bit or drill is applied by hand to the crank handle B. The crank handle B is connected to a bevel wheel C, and both the boss of the handle and the wheel are free to rotate on an axis or stud D, which is affixed by a collar E to the spindle A of the brace; F is the pad or nozzle for holding the drill. The upper end of this pad terminates in a stem G, which is free to turn within the lower end of the spindle A by which it is encased, but is prevented from being disengaged or getting out of its place by a small screw H, which takes into a groove in the stem G. I is a bevel pinion, which gears into the wheel C, and is affixed by a feather or key to the nozzle F, so that both nozzle and pinion must turn together. Rotary motion is communicated by these means to the drill from the crank handle B, while the smallness of the space required for the pinion admits of the instrument being worked much closer than usual to a wall, or parallel with it. The bosses of the wheel and pinion are both bored out to the same gauge, and are otherwise made to fit upon the same axis, so that they may be made to change places at pleasure. If the boring to be effected is light, then the pinion is retained in the position represented in the figures; but if the holes to be drilled are large, or require great power, then the wheel is put upon the nozzle of the brace, and the pinion on the stud D along with the crank handle, by which the motion of the drill is reduced, and the power increased in a proportionate degree. K is a handle or lever which occupies a recess formed in the side of the spindle A, to which it is jointed. The lever K is used in order to prevent the instrument from turning round during the operation of boring.

Fig. 3 is an elevation, and fig. 4 an under plan of a ratchet brace, which is provided with a pair of bevel wheels, by which rotary motion mny in some cases be more conveniently applied to the drill than by means of the ordinary ratchet handle. The wheel A is keyed to the brace spindle B; the other wheel C, which gears into it, has its axis upon a stud affixed to a collar placed on the brace spindle. Motion is communicated to the wheels, the spindle, and the drill by the crank handle D, which can be removed at pleasure when it is found necessary to work only with the ratchet lever handle E.

Fig. 5 is a horizontal section of another modification of brace somewhat similar to the ratchet brace, but in which the friction of the rubbing parts is made to perform the office of the ratchet wheel and ratchet. A is the brace spindle; B a collar formed upon it; C the handle or lever, which has its centre or fulcrum in the chamber D. When the lever or handle is pulled round from right to left (the direction in which it advances in boring), the point *a* of the lever presses against the periphery of the collar B, and carries round the spindle and drill along with it; but in the back stroke, or from left to right, it is relieved from its hold of the collar B, leaving the drill in its position for the forward stroke.

### *Boring Tools.*

Fig. 6 is an external elevation of a machine for drilling a number of holes at one and the same time, which will be found very suitable for boring, in clockwork, cutlery, and other such like branches of art, where sets of holes accurately and similarly placed are required; and fig. 7 is a vertical section of the principal parts of it. A A is a framework, which is cast or formed in one piece with the bed plate B (upon which the article to be bored is placed). D is a long boss, also cast or affixed to the frame A. E is a tube, which is inserted into the boss D,

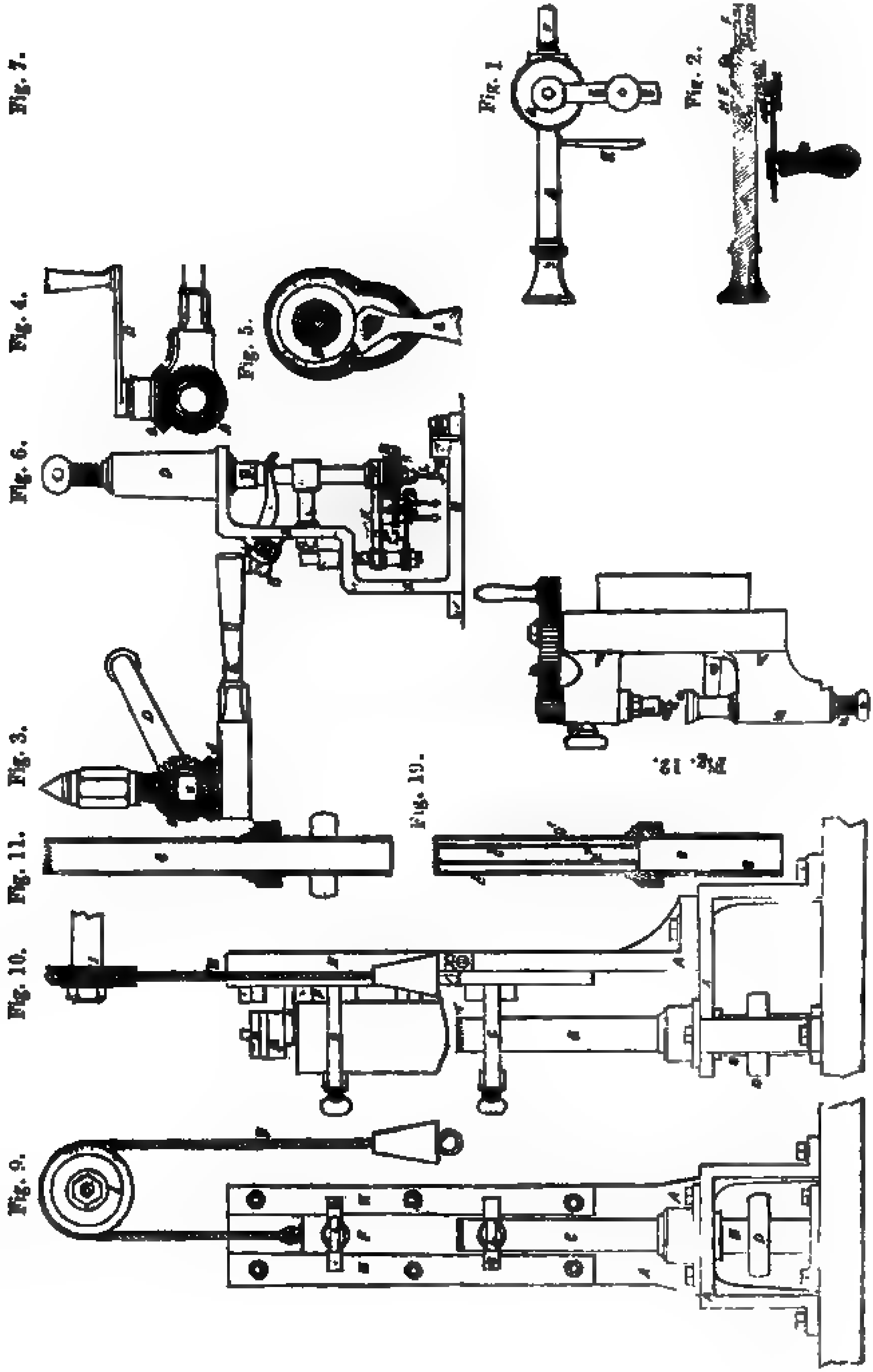


Fig. 1
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.
Fig. 19.

and has a collar upon its lower end to prevent its passing up into the boss. The upper end of the tube is formed into a nut, into which there is fitted a screw F. G is an inner tube, which slides like a telescope tube within the outer one E, and contains a helical spring H, the upper end of which abuts against the bottom of the screw F, the lower end of it pressing against the end of the tube G, so that it has a tendency to press that tube downward. I is a spindle, attached at top to the tube G, and at bottom to a frame K K, which is represented in the engraving as carrying three drill spindles $L^1$, $L^2$, $L^3$, which spindles gear into each other by the wheels M, M, M. Motion is given to the spindle $L^1$ by a band applied to the V grooved pulley N, which motion is communicated to the other spindles and their drills by the gearing M. O is a lever, by which the frame K and the drills are raised up. This is effected by the application of the foot to a treadle or strap, thus leaving both hands at liberty to place and hold the articles to be bored; and P a sliding guide, which, along with the spindle I, keeps the drills always moving in the same vertical planes. The degree of pressure exerted upon the drills is regulated by turning the screw F further up or down, so as to compress more or less the spring H. In some cases (as when the work to be performed by the drills requires great pressure), the helical spring is made double, or even treble, by having other springs of lesser diameter placed within it. $K^2$ $K^2$ are two steel plates forming part of the carriage K, which are removeable at pleasure for the purpose of varying the distances between the drills.

Fig. 8 is an elevation of a drilling machine, in which the pressure exerted in keeping the article up to the drill in boring is effected by means of a spring and screw, in a manner similar to that just described. AA is the frame of the machine, which may be mounted on a bench, or fixed in a vice, when required; B the drill, which is put in motion by the wheel gearing CC; D is the bed for the article to be bored; E the chamber for containing the spring (indicated by the dotted lines), and F the screw for regulating the pressure of the spring, as before explained. GG is a system of levers adapted for pressing back the bed, and spring, while placing the article to be operated upon in the machine. This machine, like the preceding, may be acted upon by the foot.

Fig. 9 is a front elevation, and fig. 10 a side elevation of a machine for boring telescope tubes and other like hollow articles. A A is a framework, which is securely fixed on a bench or some other firm foundation; B is a vertical hollow spindle having its bearing in the frame A A. At its upper end it has a screw thread cut into it, so that an upright hollow saw, toothed cutter, or drill, C, may be readily connected thereto. D is a pulley affixed to the spindle B, by which rotary motion is communicated to the spindle and cutter. EE is a pair of upright guides, within which there is a sliding carriage, F, to which the wood or other substance to be cut is made fast by two holders, G G. The carriage is raised up by the hand with the assistance of the cord H, one end of which is attached to the upper end of the carriage, and the other is passed over the fixed pulley I. The carriage is kept from coming down upon the revolving cutter by the ring on the end of the cord H being put on to a hook K; and when in that position the substance to be cut is fixed in the holders G G, by means of screws, L L. The end of the cord being then disengaged from the hook K, allows the carriage along with the substance to be cut, to descend upon the cutter, which should be revolving when this is done. If the weight of the carriage and the material upon it, is not sufficient to cause the cutter to enter quickly enough, the weights M M are put on the bracket N, which is attached to the carriage. A sectional elevation of the cutter is given in fig. 11; it is composed either wholly of steel tubing, or of wrought iron, or brass, steeled at the upper end, where it has formed upon it a set of saw teeth (or I employ other forms of cutters, whichever may be best adapted to act upon the material operated upon): as these teeth cut up into the solid substance of the block, the sawdust or borings fall down both inside and outside of the cutter. The saw-teeth have a considerable amount of "set" given to them, so that there may be plenty of clearance for the escape of the sawdust or borings. By the employment of this sort of cutter, nearly the whole of the substance bored out of the interior is preserved, and may in many cases be turned to useful account; the borings, for example, of wood, ivory, or metals.

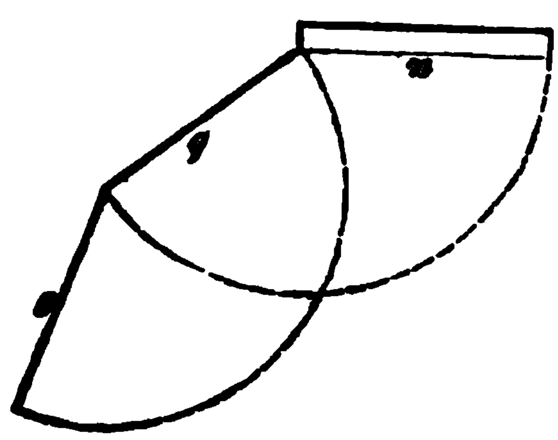
Fig. 12 is a sectional elevation of a double cutter of the sort just described, by the use of which not only the interior or core of the tube is bored out, but the exterior surface of the tube is cut or blocked out at the same time. B B is the hollow spindle of the machine, $C^1C^1$ the hollow cutter which is screwed into the spindle B. $C^2C^2$ is another hollow cutter which occupies a position in the interior of $C^1C^1$, and is concentric and parallel with it. At the lower ends of these cutters, where the junction between them is effected, there are pierced a number of small holes for the

escape of the sawdust or borings, which fall into the annular space between the cutters. During the operation of cutting, the block of material, out of which the tube is to be taken, is fixed in the machine, and the cutting proceeded with as before. When the operation has been completed, the tube is taken out of the annular space between the cutters. In the same way a greater number of cutters may be combined, and a set of different sized tubes cut at one operation.

## THE PRINTING PRESS—SUGGESTIONS FOR IMPROVEMENT.

Sir,—An improvement to the common Stanhope printing press occurred to my mind to-day, which I send to you in quite a crude form, and I am prepared to hear, either that it is not new, or that when tried, it has been found ineffective. The number and variety of the motions given to the parts of a press of the common form are not more objectionable than the great space through which these parts and the paper to be printed must be moved. It is to simplify their movements and reduce their number that the present modification of the Stanhope press is intended. Let fig. 1 represent

Fig. 1.



the single Stanhope press, so far as is necessary for the present purpose.

*a* the type-table; *b*, the tympan, and *c*, the frisket.

Before the printed sheet can be released, or a blank sheet introduced, the several points must be moved through the dotted arcs of circles, as in the sketch. As the type-table is covered when it is moved from under the platten, it cannot be inked until the tympan *b* is lifted from it, and thus a serious loss of time is occasioned. The difficulty of fixing the blank sheet accurately on the tympan is increased by its inclined position, and the fact that its face is turned to the left hand of the workman.

The new form of press which I propose is represented in figs. 2, 3, 4.

Fig. 2.

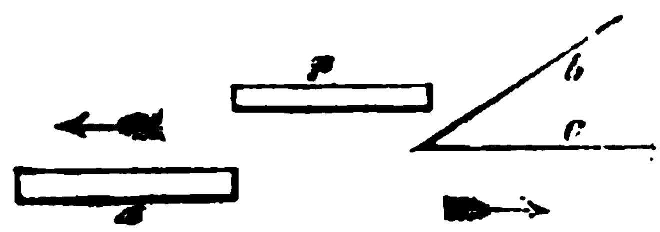


Fig. 3.

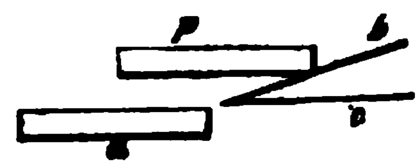


Fig. 4.

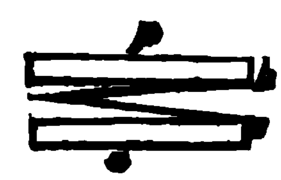


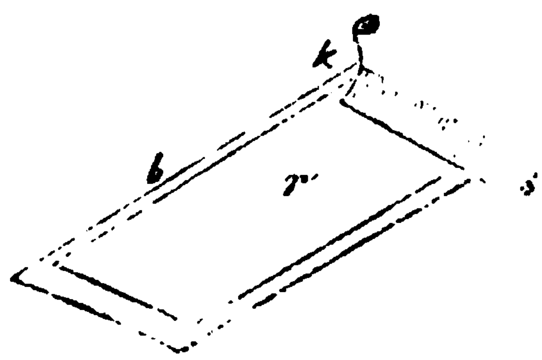
Fig. 2 shows the position of the parts when fully extended, that is, at the time when the type is being inked and the new paper introduced.

Fig. 3 represents the parts when a half motion has been completed, and fig. 4 shows the machine ready for the descent of the platten.

*a* is the type-table, which is moved out from under the platten in a direction opposite to that in which *c*, the frisket, and *b*, the platten, joined together are moved. The sheet to be printed is laid on *c*, when the machine is in the position, fig. 2. By turning the winch handle, *c* is carried under the platten while *b* closes upon it, and by the same machinery, the table *a* also approaches to a position exactly under the platten. Thus having passed through the position, fig. 3, the press will finally assume that represented in fig. 4. The platten *p*, rests at some short distance from the tympan, fig. 4; but when the press lever is pulled the platten descends and causes an

impression. The winch being again turned round, the parts again assume the position, fig. 3, and finally, that in fig. 2. The printed sheet will be found adhering to the tympan *b*, and may be removed at the same time that a new sheet is placed on *c*, and the type-table *a*, is being inked. If it be found in practice that the printed sheet does not adhere to the tympan with certainty, I would cause it to do so by the following simple contrivance, shown in fig. 5.

Fig. 5.




Let *b* be the tympan, and *r* the sheet, *s*, a metal slip hinged to the top with a curved handle, *k*. The slip *s* is kept closed by a spring flat upon the tympan, and can be opened by pressure applied to *k*.

Now, if a projecting catch be so placed as to open *s* when the parts are in the position, fig. 4, the sheet will be grasped by *s*, and so held during the passage of the machine through the state represented in fig. 3; and when the press is as in fig. 2, another catch will press on *k*, and again open the slip *s*, and permit the workman to remove the sheet. I must now mention the advantages immediately apparent in the use of this form of press. The type can be inked as it is being rolled out to the position *a*, fig. 2, so that a stationary roller fixed where the arrow is in that figure would roll *twice* over the whole type before the printing of each sheet, or if it be desired to ink the type by hand rollers, *two* boys might be employed, say A and B; and two workmen at the other end of the machine, say C and D, whose duties would be performed as follows: Let the position of the machine be fig. 2. A inks the type; C inserts a blank sheet; D is removing the printed sheet, and B is supplying his ink roller from the ink table. Next, C turns the winch handle, and D grasps the press lever to lower the platten. B is ready with his roller, while A is supplying his, the platten has descended (and is raised again). C turns the winch, and the operation is repeated from the beginning, B now inking the type in place of A, and so on.

But the distribution among the workmen of these operations, is not, of course, thus necessarily restricted, and would be modified by experience, and the proper amount of time required for the due fulfilment of each movement. Unless a double number of workmen could produce a double quantity of work when applied to a single press, the advantage gained would only be that of setting up one form of type; but I think it evident, that if the application of this proposed mode of printing is feasible, it would greatly increase the number of impressions producible in a given time by the number of workmen used at present, whether it would or not permit twice the number of men to be efficiently employed upon one press. If I find that this plan is not open to the objections mentioned in the beginning of this letter, I shall notice several of the details suggested to me as capable of being modified, so as to render its application more certain of success.

I am, yours, &c.,

JOHN MACGREGOR.

24, Lincoln's-inn Fields, June 6, 1850.

## PHILLIPS' PATENT FIRE ANNIHILATORS.—IMPORTANT TRIAL AT WOOLWICH.

Sir,—The much vaunted powers of this invention have, at last, been put to the test of *practical* application. A substantial brick building had been erected, under the auspices of the Board of Ordnance, in Woolwich Marshes, for the purpose of testing the "overwhelming powers" of the fire *Annihilator*, and for demonstrating "the infallible protection it afforded against the destructive consequences of fire."

The building consisted of three stories; viz., a shop, first and second-floor, respectively 10, 9, and 8 feet high; making with the tiled roof about 30 feet. The frontage was about 21 feet, by 25 feet deep. On each floor there were three windows in front, and two at the back. The shop-front was fitted with a glazed sash, and a small stock of light wooden articles were exhibited in the window. The upper floors were fitted up with

various articles of furniture in the shape of chairs, tables, beds, bedding, &c., so as to make the building and its contents present as nearly as possible all the usual circumstances of an ordinary conflagration.

Saturday last was the day appointed for the trial, and invitation tickets were issued by the Annihilator Company to witness the "demonstration." By 12 o'clock, the hour appointed, a numerous and highly respectable company had assembled to witness the experiment, including the Marquis of Anglesea, Master-General of the Ordnance, Lord Brougham, the *élite* of the officers of the Royal Artillery, Mr. Braidwood, the Superintendent of the London Fire Engine Establishment, and numerous scientific gentlemen and persons interested in the result of this experiment. The whole of the arrangements were under the absolute control and personal superintendence of Mr. Phillips, the patentee, who had on the ground several small *Annihilators*, one of a larger size on a hand barrow, a still larger one on a four-wheeled carriage, and a powerful wagon-shaped machine of large dimensions, drawn by a pair of horses. The building having been inspected by most of the visitors, and all being ready, the contents of the shop were fired at 25 minutes past 12 o'clock, and burned slowly for about three minutes, at the end of which time the smoke was so dense as to obscure the flames, which appeared as if extinguished; some of the panes in the shop window breaking with the heat, a current of fresh air displaced the smoke, and the flames burned with great brilliancy. At thirty minutes past twelve, the signal was given for applying the *Annihilator*, and that in the hand-barrow was backed up to the shop front, and commenced discharging its gaseous contents into the fire. At this time the shop was "well alight," and the upper part of the house filled with a suffocating smoke; but the flames had not reached the first-floor. The *Annihilator* appeared not to produce the slightest effect upon the flames, and the larger machine, called "A District or Street Fire Annihilator," was ordered up, and an attempt made to direct its jet of gas into the fire, "by means of a pipe or hose, as in ordinary fire-engines." The force of the gas, however, instantly displaced the hose, and the machine was backed up bodily to the front of the building—an operation of extreme difficulty from the heat given out by the burning mass. As in the former case, not the slightest effect appeared to be produced upon the flames, which had by this time enveloped the whole of the building. The wagon Annihilator, which had been placed in reserve, was now signalled up, the horses detached, and an attempt made to place it before the fire; but it was at first placed so near the side wall, to leeward, that the jet of gas was carried round the corner outside the building. After some delay, the unwieldy machine was shifted so as to discharge its vapour into the building, but without avail; and it was now evident to all present that the *Annihilators* were fairly and completely beaten, and they were drawn off, leaving the flames uncontrolled masters of the building, in which they revelled as long as a particle of combustible matter remained unconsumed.

Mr. Phillips proved but a sorry fireman, and by no means did his invention justice;* his men also appeared to have had no previous drilling, and to be wholly ignorant of the duties required of them. This want of preparation was, perhaps, upon the principle laid down by Mr. Phillips in his prospectuses—that "the management of the Annihilator is so *simple* and *easy* that a woman or boy may effectually apply them in case of fire with *very little instruction!*"

Mr. Phillips complained that the conflagration had gained too great an ascendancy before the attempt was made to extinguish it. But it must be borne in mind, that in almost every instance shop fires have much longer grace than was allowed in the present case; and that fires, *taken at the point at which Mr. Phillips commenced his operations*, are continually successfully extinguished by the firemen.

In this communication I have confined myself to facts; in my next, I propose to discuss the philosophy of this really important subject.

I am, Sir, yours, &c.,

WM. BADDELEY.

29, Alfred-street, Islington,
June 11, 1850.

* [The Master-General felt so sensible of this, that he has kindly offered to give the inventor another and a fairer trial.—ED. M. M.]

## LOSEBY'S PORTABLE CRANE SHOWER-BATH.

(Registered under the Act for the Protection of Articles of Utility. Edward Thomas Loseby, of 44 Gerrard-street, Islington, Inventor and Proprietor.)

Fig. 1.

*a*
I

Fig. 2.


Figure 1 of the above engravings is a front elevation of this apparatus. A, B, C are three standards or supports, one of which, A, is prolonged beyond the others, and carries a cross head D. E and F are two pulleys centred in the cross head D, and over which a cord G passes, having suspended from one of its ends the shower-bath H, while the other end is attached by means of an iron handle *a* to the hook I; K is a rod, one end of which is hinged at F, and from the other is suspended the curtain M, which is to be used for drying behind after the bath has been taken. N N are wire hoops for retaining the curtains in the circular form, and to close them instead of strings. When the apparatus is no longer required, the cord G is released from the hook I, which allows of the bath H being lowered and removed. The standards A, B, C, can then be folded together by raising the triangular line O, when the apparatus will assume the appearance represented in fig. 2.

The bath is filled by letting it down and placing the handle on the top hook. The water is then poured in, when the handle is drawn down and placed on the bottom hook. In doing this, the cord should be kept within an inch or two of the leg to which it is attached.

The advantages of this construction are, 1. Its portability; the stand only weighing 9 lbs.; 2. The small space it occupies when closed; 3. The comfort of curtained space to dry in, so that warm water may be used during the winter months without the bather having to step at once into the cold room; and, 4. The low cost at which it can be manufactured.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 13, 1850.

SAMUEL FISHER, Birmingham, engineer. *For improvements in railway carriage wheels, axles, buffer and draw springs, and hinges for railway carriage, and other doors.* Patent dated December 5, 1849.

1. "Railway carriage wheels," Mr. Fisher proposes to construct by bolting a number of segmental pieces of iron together, and to a flanged tyre on each side. The nave is made of iron in the shape of two cones united by their bases with screws tapped on each. Each of the faces of the wheel is made with a central opening, through which one of the screwed ends of the nave is put. After which, screw nuts are put on the nave and screwed up, whereby the side will be forced from the apex towards the base of the cone, and the wheel consequently distended.

2. It is proposed also to make railway carriage wheels with wrought iron spokes inclosed in a cast-iron casing. For this purpose a number of pieces of wrought iron are bent into an elbow shape, to form the spokes and felloe, and arranged, in a suitable casting mould, around a nave. The melted metal is then poured in so as to entirely enclose the spokes and felloe.

3. "Railway axles" are to be made in two pieces and united, by causing the end of one to take into a hollow in the end of the other, and preventing them from separating by means of collars and set screws.

4. "Buffer and draw springs" are to be made, in a C form, of wood (by preference beech) instead of metal, coiled helically round a core.

5. "Railway carriage and other door springs" are t ,e formed of strips of vulcanized Indian rubber, attached both to the door and door post, and hid from observation by plates.

The claims embrace the various improvements described.

THOMAS GRIMSLEY, Oxford, sculptor. *For improvements in the manufacture of bricks and tiles.* Patent dated December 10, 1849.

*Claims.*—1. Certain machinery for manufacturing bricks and tiles in so far as regards the bed plates or running tables and the cutting frames, and the parts in immediate and necessary connection therewith respectively; as also certain modifications in the cutting frames and appendages.

2. An arrangement of machinery for pressing clay to form bricks and tiles through dies in a continuous and uninterrupted stream; as also a modification of the said arrangement; and the application of the said arrangement and modification to the crushing, breaking up, and pugging of clay, for the purpose of being manufactured into bricks and tiles.

3. The forming of bricks for the purposes aforesaid with longitudinal holes (*c c*); as also different forms of bricks.

4. The employment in the construction of drains and sewers, and other conduits of liquids and liquid matters, of bricks, glazed on those parts of their surfaces, over which the said liquids or liquid matters are designed to flow.

5. An improved drying kiln, in so far as regards the combination of four or more chambers, or compartments (capable of being used collectively or individually) with a drying-room or rooms, over the same.

A more particular description of these improvements, illustrated by engravings, will be given in an early Number.

EDWARD CARTER, Merton Abbey, Surrey, machinist. *For improvements in printing calico and other fabrics.* Patent dated December 5, 1849.

The patentee first describes—

1. An apparatus for applying colour to blocks, which consists of a frame furnished with wheels, and so constructed that it may be easily moved over the printing table, and inclined in any required direction across its surface. In this frame, which is inclined from one side of the table to the other, there is mounted the colour box, the rollers for applying it to the blocks, and the distributing rollers. The axles of the colour-applying rollers are provided at one end with rollers, to the peripheries of which bands of vulcanized Indian rubber are made fast. A second frame, provided with wheels to run to and fro on the first, is placed above it, and carries a rod, roughened on its under side, which is depressed when the block is placed on the second frame, and forced into contact with the wheels. When the printer pushes the second frame up the first, the frictional contact of the rod and wheels will cause the rollers to rotate, and consequently apply colour to the printing surface of the block. When the block is lifted off the second frame, the latter runs down the first to its original position. To prevent injurious effects from concussion, both ends of the second frame are provided with buffers.

2. A mode of preparing blocks for printing both sides of a fabric, is next described, whereby colours and patterns may hit or

come exactly opposite each other. One of the sets of blocks is prepared in the usual way, while the pattern is cut on the other in the reverse direction. In order that the patterns on each may correspond exactly, the first block is coloured, and then passed over the second to transfer the pattern thereto, and guide the workman in engraving it. To enable him to ascertain if any inaccuracies have occurred, it is proposed to transfer the pattern from the first block to a transparent fabric, which is then to be supported in a hinged frame above the second, and applied to it, whereby any discrepancy between the two will be easily detected. The fabric to be printed is stiffened with gum water, and is stretched and supported in frames. When dried, it is laid on the printing table, printed on one side, removed, and dried again; after which, the printed side is laid on the table and printed with the reverse blocks, removed, dried, and finished off.

3. An arrangement of machinery is also described for printing both sides of the fabric in different colours successively. A number of sets of rollers are prepared for printing both sides in the same way as in the preceding case. These rollers are supported in a framing, and the axle of each has a toothed wheel on one end, which gears into a screw on the main shaft, whereby rotary motion is communicated from the steam engine or other prime mover to the printing rollers. Above and beneath each series of printing rollers are a number of colour boxes and distributing rollers, the latter of which are driven, through the intervention of toothed wheels, by the rotation of the printing rollers themselves. The fabric to be printed is led from a roller on which it has been previously wound between the different sets of printing rollers, after which it is dried. When it is desired to print two fabrics at the same time in different colours, they are passed through the printing rollers as before, but with a backing between them.

Jean Baptiste Ecarnot, France. *For improvements in the manufacture of sulphuric, sulphurous, acetic, and oxalic acid, and nitrates.* Patent dated December 10, 1849.

The patentee states that in manufacturing the acids enumerated in the title of his patent, a bioxide of azote is formed, which combines with the oxygen of the air, and escapes in the form of hypo-azotic acid, and is consequently lost. The latter is soluble in steam or water, and forms in addition bioxide, which has again to be converted. Now the present invention consists in subjecting the bioxide, in a close vessel, to the conjoint action of air, steam, and water. For this purpose he employs a vessel, or hollow column, composed of earthenware pipes, strongly luted together, and filled with pumice stone. The bioxide is conveyed to the top of the column, and is made to percolate through the porous substances, and meet a current of air, which is driven up from below by a fan or other blowing apparatus. Steam and water is also made to accompany and mingle with the bioxide in its passage through the close vessel.

No claims are made in this specification.

William Holt, Preston-place, Bradford, organ builder. *For certain improvements in the construction of the pallets, or valves of organs, sound boards, or wind chests, the same being applicable to seraphins, colophons, harmonicons, harmoniums, and all other musical instruments in which the tone is produced by the admission of wind supplied by bellows, or other machinery, to pipes, reeds, or springs,* "and also to various other purposes connected with all the above-named musical instruments." Patent dated December 10, 1849.

The patentee, who has filed a disclaimer of the latter part of his title, which is here printed in Roman letters, states that his invention has for its object to render the playing of wind instruments easier than heretofore, by making the valve in two pieces —one being attached to the wire, which is connected to the key, and hinged to the other or larger one. The wire passes through an elbow-piece projecting from the inside of the larger portion of the valve, and is provided with nuts at a short distance above and below it. Both portions are kept in position by means of two separate springs. When the key is depressed, the smaller portion of the valve will be opened, and the atmospheric pressure on both sides of the valve immediately rendered equal. The continued descent of the key will bring the top nut into contact with the elbow-piece, and drag down with it the larger portion of the valve. By this arrangement, only a very small portion of the area of the valve will have to act against the unbalanced pressure of the atmosphere.

## RECENT AMERICAN PATENT.

(From the *Franklin Journal.*)

For an Improvement in Spark Arresters. *James A. Cutting.*

The nature of this invention consists in placing above the top of the chimney a deflecting cap made in the form of an inverted funnel, with the outer part bent down all around in a curve, to reverberate the pro-

ducts of combustion and force them down, when this is combined with a series of radial and inclined or curbed shutes or passages, arranged below the deflecting reverberating cap, through which the products of combustion pass, and by which they are, at the same time, caused to take a revolving motion around the chimney, so that the sparks and other solid matter may be forced into a receptacle below, through a series of radial apertures in a diaphragm, each of the said radial apertures being provided along one edge with an inclined flanch, the better to catch the sparks, &c., and cause them to be deposited, while, at the same time, the passage of the currents through the series of shutes has the effect, in part, to exhaust, whenever the force (such as a jet of steam) which impels the draught is momentarily suspended, and thus continue the draught during the pulsations of the jets of steam.

The invention also consists in combining with the reverberating cap and series of radial and inclined or curved shutes, an external series of radial and inclined or curved shutes, outside of the first series, together with apertures in the casing, leading into another receptacle, so that, after the products of combustion have been carried around in one direction, the current shall be caused to change its direction, and also to turn upwards and outwards to pass through the second series of shutes, and, whilst revolving, force the solid particles through the apertures into the surrounding and outer receptacle, the reversing of the direction of the revolution below the two series of shutes having the effect to deposit the solid particles in the lower receptacle more effectually than would otherwise be the case.

*Claims.*—1. The deflecting and reverberating cap, and the chimney, in combination with the first series of inclined or curved shutes below the top of the chimney.

2. The perforated diaphragm below the shutes, in combination with the inclined shutes and cap.

3. The second series of inclined or curved shutes, in combination with the first series of shutes, the cap, and the chimney.

4. The surrounding apertures leading into a receptacle for sparks, in combination with the two reversed series of inclined shutes.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

A grant unto William George Bicknell, of Essex-street, Strand, and James Reginald Torin Graham, of the Grove, Clapham Common, of an extension for the term of six years of letters patent granted by His late Majesty King William the Fourth to Miles Berry, of Chancery-lane, patent agent, for an invention of certain improvements in machinery or apparatus for cleaning, purifying, and drying wheat or other grain or seeds. June 7.

William Newton, of Chancery-lane, civil engineer, for certain improvements in the manufacture of cords, ropes, bands, strong cloths, quilting sacks, and cushions, and in elastic material for stuffing the latter, in which manufacture caoutchouc forms an essential ingredient, and in the application of parts of these improvements to the manufacture of pads, stoppers, tubes, boxes, baskets, coverings, wrappers, and other like articles of utility. (Being a communication.) June 8; six months.

James Colman, of Stoke Mills, Stoke, near Norwich, Norfolk, mustard and starch manufacturer, for improvements in the manufacture of starch. June 8; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, London, for certain improvements in oscillating engines put in motion by steam, and gas resulting from combustion. (Being a communication.) June 8; six months.

Charles Warwick, of Cheapside, warehouseman, for improvements in apparatus for taking up the work of certain descriptions of knitting machinery. (A communication.) June 8; six months.

Peter Armand Lecomte de Fontainemoreau, of South-street, Finsbury, for certain improvements in the manufacture of sulphate of soda, muriatic and nitric acids. (Being a communication.) June 11; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in machinery for carding cotton, wool, or other fibrous materials, and in apparatus for preparing or setting the cards of carding engines. (Being a communication.) June 11; six months.

William Jackson, of Kingston-upon-Hull, soap-maker, for improvements in the manufacture of soap, and in the preparation of materials to be used for this purpose. June 11; six months.

William Edward Newton, of Chancery-lane, civil engineer, for improvements in rotary engines. (Being a communication.) June 11; six months.

Robert Waddell, of Liverpool, Lancaster, engineer, for certain improvements in steam engines. June 11; six months.

Alexander Parkes, of Pembrey, Carmarthenshire, experimental chemist, for improvements in smelting and treating certain metals, and in the construction and manufacture of furnaces and the materials to be used for the same, such furnaces and materials being applicable to the treatment of metals and metallic compounds, and to various other useful purposes of a like nature. June 11; six months.

William Pole, of Great George-street, Westminster, engineer, and David Thomson, of Belgrave-road, Pimlico, engineer, for improvements in steam engines. June 11; six months.

John Henry Vries, of Norfolk-street, Strand, Middlesex, Esq., for improvements in working engines by atmospheric air. June 11; six months.

James Palmer Budd, of the Ystalyfera Iron Works, Swansea, merchant, for improvements in the manufacture of coke. June 11; six months.

John Dearman Dunnicliff, of Hyson Green, Nottingham, lace manufacturer, and John Woodhouse Bagley, of Radford, in the said county, lace maker, for certain improvements in lace and other weavings. June 11; six months.

Samuel Ellis, of Salford, engineer, for improvements in machinery or apparatus applicable to all kinds of carriages used on railways. June 11; six months.

Frederick Albert Gatty, of Accrington, Lancaster, manufacturing chemist, for a certain process or certain processes for obtaining carbonate of soda and carbonate of potash. June 11; six months.

William Cox, of the firm of William Cox and Co., of Manchester, cigar merchant, for certain improvements in machinery or apparatus for manu-

facturing aerated waters, or other such liquids. June 11; six months.

John Sidebottom, of Broadbottom, Chester, manufacturer, for improvements in looms for weaving. June 11; six months.

William Mac Lardy, of Manchester, machinist, for certain improvements in machinery or apparatus for preparing and finishing, and doubling cotton and other fibrous materials. June 12; six months.

Alfred Vincent Newton, of Chancery-lane, Middlesex, mechanical draughtsman, for improvements in the production of gases to be used for lighting, heating, and motive power purposes. (Being a a communication ) June 12; six months.

Gustavus Palmer Harding, of Bartlett's-buildings, London, artificial florist, for improvements in the manufacture of buttons and other fastenings. June 12; six months.

Thomas Deakin, of Balsall Heath, Worcester, Esq., for certain improvements in machinery and apparatus to be used in rolling metals and in the manufacture of metal tubes. June 12; six months.

John Stopporton, of the Isle of Man, engineer, for certain improvements in propelling vessels. June 12; six months.

William Edward Newton, of Chancery-lane, civil engineer, for certain improvements in the construction of railways. (Being a communication.) June 12; six months.

George Allen Everitt, of the firm of Allen, Everitt, and Son, of the Kingston Metal Works, Birmingham, metal and tube manufacturers, and George Glydon, of Birmingham aforesaid, engineer and foreman to the said Allen, Everitt, and Son, for certain improvements in the manufacture of metal tubes for locomotive, marine, and other boilers. June 12; six months.

John Manly, Jun., of Birmingham, manufacturer, for certain improvements in the manufacture of nails. June 12; six months.

## LIST OF IRISH PATENTS FROM 21ST OF APRIL TO 19TH OF MAY, 1850.

William Garnett Taylor, of Burton Hall, Westmoreland, for improvements in lint and in linting machines, which improvements in linting machines are, in whole or in part, applicable to other purposes. April 30; six months.

William Brown, of Airdrie, Lanarkshire, electrician, and William Williams, the younger, of St. Dennis, Cornwall, gentleman, for improvements in electric and magnetic apparatus for indicating and communicating intelligence. May 2; six months.

George Edmond Donisthorpe, and John Whitehead, of Leeds, manufacturers, for improvements in preparing, combing, and hackling fibrous matters. May 10; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| June 6 | 2328 | John Rowan and Sons | York-street Foundry, Belfast.... | Factory ventilators. |
| 8 | 2329 | George Frederic Hipkins .................... | Birmingham........................... | "The Sportsman's Companion," combining nipple-wrench, turnscrew, nipple-pricker, wafer-stamp, and corkscrew. |
| 10 | 2330 | C. A. and T. Ferguson | Millwall................................ | Gun carriage. |
| ,, | 2331 | Edwin Greenslade Bradford........................ | Teignmouth, Devon, Jeweller... | Fastener for garments. |
| ,, | 2332 | John Edward Smith.... | Lawrence-lane, Cheapside ....... | Shirt. |
| ,, | 2333 | Thomas Grubb .......... | Dublin, Civil Engineer ............ | Spindle and bearing for the dashers of revolving dasher churns. |
| 11 | 2334 | James William Giles... | Aldersgate-street.................... | Dress pin. |

## CONTENTS OF THIS NUMBER.



LONDON: Edited, Printed, and Published by Joseph Clinton Robertson, of No. 166, Fleet-street, in the City of London.—Sold by A. and W. Galignani, Rue Vivienne, Paris; Machin and Co., Dublin; W. C. Campbell and Co., Hamburgh.

# Mechanics' Magazine,

## MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1402.] SATURDAY, JUNE 22, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.

### MR. MONTGOMERY'S PATENT DISTILLING APPARATUS.

Fig. 1.

Fig. 4.

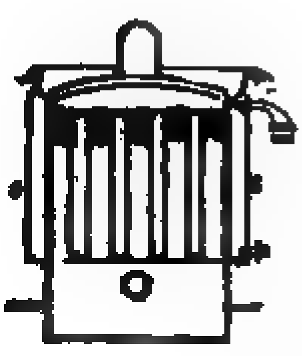


Fig. 5.

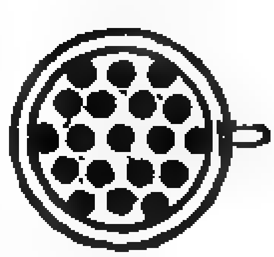


Fig. 3.

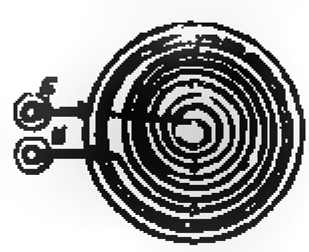


Fig. 2.

## MR. MONTGOMERY'S PATENT DISTILLING APPARATUS.

(Patent dated December 8, 1849. Specification enrolled June 8, 1850. Patentee Conrad Montgomery, St. James'-square, Esq.)

*Specification.*

*Firstly.* My invention consists of an improved method of obtaining alcoholic spirit from vegetable substances, which is more especially applicable to substances of low saccharine properties; that is to say, containing sugar, but not in sufficient quantities to warrant the treatment of them for the extraction of sugar alone. I take the substance, say, for example, the sawdust of fir or other wood, and subject it to the action of steam of considerable pressure, until it attains to a pulpy or pasty state. I then convert it into gum by adding strong sulphuric acid in the proportion of about one part (by weight) of the acid to one thousand parts of the vegetable mass. I next boil the gum in water, until it is changed into sugar. When this change has been completed, I add a quantity of chalk in order to neutralize the sulphuric acid; and then subject the mass to fermentation in the usual way, and distil it over.

*Secondly.* My invention consists of certain improvements in the process of distilling. Fig. 1 is a side elevation of a distilling apparatus embodying these improvements. Fig. 2 is a sectional elevation of the part of the apparatus above the stage S, and between the still head H, and condenser R, to which part my improvements have more particular reference. A is a receiving vessel, into which the shorter vapour pipes open from the still-head H. A′A′ are six (or more) shallow pans with perforated bottoms (to allow of the spirituous vapour passing through) which are mounted on the top of the receiver A; each pan fitting into that beneath it, and forming a cover to it, with the exception always of the first pan, which fits into the receiver A. These pans are in the body part *a a* of a hemispherical form, but terminate in straight bottoms *b b;* and they are divided internally by partitions *c c* into two circular compartments $d^1 d^2$. A plan of one of these pans is given separately in fig. 3. The centre compartment $d^2$ of each pan is filled to about the height shown with charcoal or any other suitable filtering material, and imbedded in this filtering material there is a coil of pipes *e e*, through which cold water is kept constantly flowing. Each coil is supplied from a stand pipe B; and the water, after circulating through the coil discharges itself into the outer circular compartment of the pan $d^1$, from which again it passes off into a discharge pipe E. A constant circulation of cold water is thus kept up through and around the filtering medium which keeps it at a temperature exceedingly favourable to the separation of the essential oil from the spirit in the course of its upward passage through the filtering pans. From the last pan the purified spirit is carried over by a pipe F into the condenser R.

A modification of the preceding arrangements is exhibited in figs. 4 and 5. Here the filtering material is contained in a number of cylinders set upright within a circular vessel G, and provided with perforated bottoms, through which the spiritous vapour ascends; and cold water is kept constantly circulating around and between these cylinders.

Both of the arrangements just described may be used either for distilling or rectifying; that is to say, for distilling from the waste or for rectifying raw spirit.

And, *Thirdly.* My invention consists of another improved method of rectifying or purifying spirits. I made use for this purpose of a close vessel, which is composed at bottom of woven wire or perforated metal, covered with thick felt, or hair cloth, or other like porous material, and has an air-tight fitting cover at top, with means for making it fast under any pressure to which it may be requisite to subject it. I fill this vessel to near the top with the charcoal or other filtering medium, and then make the cover fast. The spirit to be rectified or purified is then introduced by a pipe into the vacant space in the upper part of the vessel, and forced down through the filtering materials by means of hydraulic pressure, which may be either effected by means of a head of water or of an hydraulic pump.

I do not confine myself to the use of a single vessel alone, but contemplate using as many vessels, two, three, or more, as may be found necessary, deemed expedient according to the more or less purity desired to be given to the spirit.

For Claims, see *ante* p. 458.

THE EFFECTS OF MACHINERY ON THE WELFARE OF THE LABOURING CLASSES.

(Concluded from page 446.)

To one of the causes referred to in my last communication, viz.: a large expenditure on foreign luxuries, of the money saved by the cheapness of British goods through the introduction of machinery, I cannot help thinking that much of the destitution of the manufacturing population may be traced. Comparing the present state of our labouring classes with their condition a century or so ago, we should find, I think, that whilst those who *are* employed are better off now than formerly, there are *more* persons *unemployed;* that whilst a little money goes much farther in procuring comforts than it did formerly, it is more difficult *to get that little.* The difference between the condition of the rich and poor has been rapidly widening—not, by any means, so much through a debasing of the latter, as through a very rapid and great elevation of the former. Even if the great mass of the people has upon the whole *progressed* in comfort, the progress of the capitalist and wealthy classes has been still greater. The progress has not been *proportionate* in the two classes, or anything like proportionate. The whole history of commerce, as well as that of private merchants and capitalists, has always appeared to me a striking exemplification of the saying, "To him that hath shall be given." Wealth produces wealth, capital increases at an enormously increasing ratio. The individual labourer has become of less importance. The machine has made the master more independent of the workman. I do not forget that the manufacturer is still dependent to a certain extent, on his workmen, and that "strikes" inflict a severe injury on the employer. But *on the whole* the capitalist is more independent of the operatives he employs, since the introduction of machinery, than he ever was before. The machine is more beneficial to its owner than to anybody else.

Several writers have seen this plainly, and different schemes have been proposed, having for their object to give to the labourer a greater share of the benefits of his labour—to make him, in short, a partner in the profits of the capitalist. Mr. Babbage, in his well-known work on "The Economy of Machinery and Manufactures," has proposed a plan which seems to be practical without much difficulty, and to be free from the absurdities which have characterized the recent French schemes of Louis Blanc and Co. And, in fact, such a plan has been actually in operation, with excellent effect, for several years in the establishment of a M. Leclaire (Vide *Chambers's Journal* for September 27, 1845.) I must refer the reader to Mr. Babbage's work for details of this plan.—[Chap. XXVI. "On a New System of Manufactory." p. 250, 4th ed.] Mr. John Stuart Mill has also taken up Mr. Babbage's suggestions, which he approves of and illustrates by other examples (Principles of Pol. Economy, Book iv. Chap. 7.) But though some such arrangement for securing to the labourer a greater share than hitherto, will probably be adopted and become general at some future time, there are some remedies applicable to the evils of the existing state of things.

Fluctuations in manufacturing industry have become almost certain periodical events. The oscillations of a pendulum are scarcely less sure to occur, than those alternate periods of "brisk demand" and "full employment," and "dull market," "hands dismissed," "factories closed or working half time." This is not the place to inquire into the causes of such fluctuations: all we have to do with them is, in so far as they bear on the operatives. The effect is similar to the introduction of new and more powerful machinery, in throwing hands out of work for a longer or shorter time; and from whatever cause this arises, a remedy is to be sought for the evil produced.

One remedy is obvious enough, and has been enforced on the suffering classes, over and over again, by almost every person who has had anything to say or do with such matters, and that is, to save a portion of the high wages received in a period of prosperity, and lay them by against a time of need. But such exhortations are thrown away on the careless, ignorant, and thoughtless masses. Experience shows of how little use it is to preach these doctrines, how-

ever sound and important, to the unreflecting and childish gin-drinker. The only effectual way to benefit them is, to take care of them *in spite of themselves;* and keep them from extravagance by not affording them the means of squandering.

It is to the masters, the employers, that we must appeal: and a very simple and effectual plan may be brought into use, by dint of a little patience and management—and that is, *to keep back part of the wages* and invest them *in the bank* for the benefit of the operative. This plan has been acted on in the neighbourhood of Newcastle, for some time, and with excellent effect. It was opposed, at first, of course, and the men refused for some time to engage with a master on such conditions; but they soon found the benefit of such a course when they tried it, and, after a time, it was as eagerly sought by the men themselves as by the employers.

Here, in Northumberland, the farmers also have an admirable plan of paying their labourers, which is also common in Scotland. They are hardly paid any money at all (perhaps only three or four pounds, and that only once a year), but receive so much wheat, so much barley, oatmeal, &c., &c., and have a cow kept for them, and some potatoes or a plot of ground for growing some. Now the effect of this arrangement is, that having no money in their pockets, they cannot go and squander half their week's earnings at the public-house, like their unfortunate fellow-labourers in other parts of the kingdom. There is no want of *food*—no starving mother and children, no famished wife waiting at the door of the gin-shop on Saturday night, to drag away her drunken husband before he has spent every farthing. Only those who have lived amongst, and witnessed these two different states of things, can fully comprehend and appreciate the blessings of the plan I have just mentioned.

Now, why should not something of the kind be adopted in the manufacturing districts? The great majority of the labouring classes are just as thoughtless and ignorant of their own real interests as the veriest children. In fact, they are, mentally, babies, and must be treated as such by their employers, if sincere regard is felt for their welfare. Such a state of things, it is to be hoped, will not last long. The spread of education and moral training will, in time, no doubt, make men fit to govern themselves. But at present they are *not* able to take care of themselves, and every effort should be made to prevent their squandering their money and ruining their health, in the childish way they are going on at present.

I would, therefore, earnestly urge the consideration of this matter on every manufacturer and employer of labour, who may happen to read these pages; the plan is no mere piece of theoretical philanthropy, such as "practical" men consider themselves authorized in scouting and ridiculing. It is a plan which has been the only one known, for time immemorial in some parts of the kingdom amongst the agricultural, and has also been tried in several manufacturing and colliery districts, and succeeded admirably. There may be some difficulty in introducing it in new localities, but there is no reason why these difficulties should not be overcome as well as in the neighbourhood of Newcastle. There are various forms in which the principle might be carried out with a greater or less degree of completeness and detail. For instance, the plan might simply be,—

(1). To keep back a certain portion of the wages every pay-day, in the periods of high wages, and to place these in a savings bank (when these institutions are restored to their former credit and security); or

(2). The wages, instead of being paid in money, might, as in the agricultural districts I have named, be paid "*in kind*," *e.g.*, so many bushels of wheaten or barley flour, &c., and this might extend to groceries, clothes, &c.

In adopting this more complete system, there would be several points to be attended to; such as a guarantee to the operative that he shall not be cheated in any way, either by bad articles or false weights, &c.

Of course there would be very little need of any such guarantee with respectable employers, but such guarantees would be found necessary to exclude any possibility of suspicion or complaint. A great many collateral advantages would attend such a plan; for example, the employer, purchasing at wholesale prices, would be able to let his workmen have much better articles, at much lower prices than the ordinary

run of petty shopkeepers. Every one who knows anything of the poor, is aware how much they lose in this way, even in towns; and in country places it is astonishing how little they get for their money, compared to what their richer neighbours get. The ounce of coarse bad tea, for instance, costs more to the poor man than an ounce and a half of the very best tea, if purchased by the pound. This does not result from the extravagant charges of the shopkeepers, for they must get enough to live on, and when such petty quantities are sold, this can only be done by greatly increased prices. Then,

(3). If the employer could also purchase a piece of land in the neighbourhood of the factory, or place of work, and let this out in small plots to his people, at a rent sufficient to make it profitable to them, very great benefits would be gained in every way. Even if no pecuniary advantages were gained, there would be health and recreation gained. But there is perhaps hardly any land, even in the neighbourhood of towns, which might not be made a source of even pecuniary gain, when under garden cultivation.

This, which I can hardly call a "secondary employment," inasmuch as I could only contemplate the assignment of such small plots as would employ the leisure hours of a man and his family, would still leave this further problem "of secondary employment" suggested by "M. S. B." to be solved.

The sooner some such plans as the above are introduced, the better. The amount of wages squandered every week, and worse than lost, is perfectly enormous and frightful to think of. The amount spent annually on intoxicating liquors alone is more than enough to pay the whole taxes of the nation. Now it is utterly useless to preach and inveigh against "alcohol," unless you substitute some other source of enjoyment in its stead. The poor man goes to the public-house and the gin-shop in search of some little pleasure and recreation. He soon ruins his health, and probably knows he is ruining it; but unless you give him some other pleasure instead, he will persist in snatching this temporary gratification at the expense of future misery. The consideration of the future has no influence on him; being then what he is, the only practical remedy is to give him some other source of *present* enjoyment. Give him then a garden to begin with. We have scores of other amusements in store for him, but try this as a first experiment; and, at any rate, let it not be despised and ridiculed, *till it has been* tried.

P. S. On the subject of this Essay, a great amount of interesting information and entertaining matter will be found in Mr. Charles Knight's little work "Capital and Labour," published as one of his "Shilling Volumes."

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*Errata*.—Page 444, col. 2, line 10, for "*several* investigations," read "*general* investigations;" line 48, for "*fact*," read "*part*."

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## RUSSIAN METHOD OF TANNING LEATHER.

Sir,—Many descriptions have been given of the mode of tanning leather in Russia, though it does not seem that British manufacturers have hitherto succeeded in performing the operation so expeditiously as it is done in some parts of that country. The leather of Kazan having there been esteemed as of the best, Sir Samuel Bentham informed himself of the particulars of the whole process by actual inspection; possibly the notes he made on the spot may indicate some peculiarities of practice at Kazan which may be useful here even at this day; should you think so, they are at your service.

The most remarkable part of the process noted is, perhaps, that of the means taken to apply the tanning infusion to the *interior* of the skins, and of forcing it through the whole substance of them.

The property Russian Morocco leather possesses of repelling insects, is well known to depend on its being dressed with droughet, the essential oil of birch-bark, yet this oil has hitherto been but little employed for the preservation of British leather, or, indeed, of any other article subject to the attacks of moths.

Some specimens Sir Samuel obtained at Kazan of Morocco leather still exist, and are of excellent quality. Russia leather of the lighter kinds is soft and beautiful—such, for instance, as the printed kid of which shoes are made, and it is exceedingly cheap; but sole leather, and that for boots and the upper leathers of men's shoes, easily lets in water, and is in some

other respects far inferior to leather prepared in England for the same purpose.

M. S. B.

*Notes made at the Leather Factory at Kazan by Sir Samuel Bentham.*

The hides to be tanned may be either fresh from the animal or dry, no matter which: they are first laid to soak for three days and nights in a solution of potash, to which some quicklime is added. The potash used is made of the tree called in Russ *ilim* (the common elm), which sort is said to be preferable to any other, if not essential; it is not purified, so that it is of a brown colour and of an earthy appearance: about twelve ponds* of this, and two ponds of lime, serve for a hundred skins; as they have no way of ascertaining the degree of causticity of the alkali but by its effect on the tongue, when they find it weak they let the skins lie longer in the solution.

When the skins are taken out of this solution they are carried to the river, and left under water for a day and a night.

Next, a vedro† of dog's dung is boiled in as much water as is enough to soak fifty skins; but in the winter time, when the dung is frozen, twice that quantity is found necessary. The skins are put into this solution not while it is boiling hot, but when at the heat which the hand can bear; in this they lie one day and one night.

The skins are then sewed up so as to leave no hole—in short, so as to be water-tight; about one-third of what the skin will contain is then filled up with the leaves and small twigs chopped together of the plant called in Russ *toloknanka* (*arbutus uva-ursi*, sometimes called bear-berry), which is brought from the environs of Solikamskaga, and the skin is then filled up with water. The skins thus filled are laid one on the other in a large trough, and heavy stones upon them, so as, by their weight, to press the infusion through the pores of the skin in about four hours; yet, as they told me at the same time, that the skins are filled up with the same water which had been pressed out *ten* times successively, and that the whole operation takes but one day and night; this leaves but two hours and a half for each time.

The skins are then again taken to the river and washed, and are then ready for the dyeing. The whitest skins are laid aside for the red and yellow leather.

(The operations in dyeing follow, but are here omitted.)

To soften the skins after dyeing, they are *harassed* by a knife, the point of which is curved upwards.

They are then laid upon two perpendicular rounded plates of iron, not very sharp; and while the skin is pressed by the hands tight on these two edges, it is forced to bend and pass over them by the knee, which is pressed down between the two plates, so as to draw the leather with it. A kind of brush is then used of the shape of that with which horses are smoothed, but made of wood, the sole of which is a little rounded and cut by transverse grooves.

For polishing the leather, it is laid on the edge of a board which is not quite sharp; the part of the leather on that edge is rubbed by a stick pressed transversely on it; on this stick is a notch, into which the edge of the board, with the leather on it, fits exactly; and to prevent the necessity of shifting the different parts of the skin on to the edge of the board, the notch in the rubbing-stick is continued round the stick several times in a spiral manner, so that merely by the rubbing, the skin is made to pass over the edge of the board. The wood of which these instruments are made is the *klenovoi* (*acer platanoides*, or Norway maple).

* The pond is 36 lbs. English.

† The vedro, equal to 2,696 English imperial gallons.

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NOTES ON THE THEORY OF ALGEBRAIC EQUATIONS. BY JAMES COCKLE, ESQ., M.A., BARRISTER-AT-LAW.

(Continued from p. 229.)

*Third and Concluding Series.*

## II.—SYMMETRIC PRODUCTS.

1. Although, perhaps, not in strictness necessary, it may be as well to observe that the symmetry of the expression

$$X'Y'Z'..+X'YZ'..+XY'Z'..+\&c.,$$

follows naturally from the considerations enunciated in Article 8 of the last of

these Notes (*supra* p. 227.) We have only, in place of a formula there employed, to use the following—

$$ep^m . fq^m . gr .. + ep^m . fq . gr^m .. + \&c.$$

which is manifestly symmetric. The expression

$$X'Y'Z'...$$

(in which all the letters are accented) will of course be symmetric and in no respect different from

$$XYZ...$$

except that, whenever $x$, $y$, &c., occur in the latter expression, they will have to be replaced by $x^m$, $y^m$, &c., in that which precedes it.

2. The following notation may be found convenient. Let P, Q, R, ., &c., denote the respective values of X, Y, Z,., &c., when, in these latter quantities, we substitute for $x$, $y$, $z$,., &c., the quantities $x'$, $y'$, $z'$, ., &c., respectively; and let P′, Q′, R′,., &c., be the same functions of X′, Y′, Z′,., &c., respectively that P, Q, &c., are of X, Y, &c.

3. The reader will be pleased to make the following corrections in my last Note. In the denominator of the fraction at line 9 of the left hand column of p. 229, (*supra*), for $\beta^3 + \&c.$, *read* $\beta^6 + \&c.$ That denominator is, in fact, $(xyz)^2$. Also, at line 11 of the note (†) to the same column and page, *for Ibid*, *read Camb. and Dublin Math. Jour.*

## CUBIC EQUATIONS.

4. If (*vide supra*, p. 228) we adopt the assumption

$$x = \beta x' + x'^2,$$

the following relations will obtain, viz.—

$$X = \beta P + P'$$

$$Y = \beta Q + Q'$$

$m$ being here equal to 2. Hence the product, (the *symmetric product*) XY, will be equal to

$$\beta^2 PQ + \beta(P'Q + PQ') + P'Q',$$

in which expression we see, from what I have already stated, that $x'$, $y'$, &c., occur symmetrically. We thus may by this, as by other methods, ascertain *a priori* the possibility of solving the general cubic equation.

5. Before proceeding to the numerical illustrations promised at the conclusion of my last note (*sup.*, p. 229), I shall transcribe here, from the *Philosophical Magazine*, a solution of a cubic, wanting its second term, which I communicated to that Journal, and which was published at pp. 502-3, of vol. xxii. of its Third Series (June, 1848). It is, I am inclined to think, the simplest form which the solution of an imperfect cubic is capable of taking, and may be termed the

### *Subsidiary* Solution.*

Let

$$x^3 + ax + b = 0 \ldots . (1.)$$

Assume

$$x^3 + 3px^2 + 3p^2x = -b .. (2.)$$

Subtract (1.) from (2.) and divide by $3px$: then

$$x + p = \frac{a}{3p} \ldots\ldots (3.)$$

Add $p^3$ to each side of (2.): then

$$(x+p)^3 = p^3 - b$$

$$= \left(\frac{a}{3p}\right)^3 \dagger \text{ by (3.)},$$

$$\text{or } p^6 - bp^3 = \left(\frac{a}{3}\right)^3$$

a quadratic in $p^3$ $\therefore$ $p$ is known, and, by (3)

$$x = -p + \frac{a}{3p}.$$

For some remarks on this solution I refer the reader to the First Series of these Notes, *vide Mech. Mag.*, vol. xlvi., pp. 105, 124; and more particularly the note (†) of the latter page.

6. I now proceed to the following

### *Practical Numerical Method,*

which will be found useful whenever the finite rigorous expressions for the roots of a cubic are required, and the earlier operations of which furnish us, in *all* cases, with a simple means of ascertaining the nature of the roots of any cubic. The process is founded on my solution of a (perfect) cubic alluded to in the concluding paragraph of the last of these Notes (*supra* p. 229), and has been already given by me, with examples, at pp. 196-7, of vol. i. of the *Mathematician*. I shall here enunciate the rule in a somewhat different manner from that in which I originally propounded it,

---

* As to this term *subsidiary*, see *Mech. Mag.*, vol. xlvi., p. 124.

† The index of this expression is accidentally omitted in the *Phil. Mag.*, s. iii , vol. xxii., p. 503.

and shall then proceed to illustrate it by examples.

7. Let

$$x^3+ax^2+bx+c=0\ldots\ldots(4.)$$

be a given cubic. Then it will, in general, materially conduce to ease and simplicity of application of the rule, if we (1) clear the equation of fractions, and render $a$, $b$, $c$, integers, and (2) if, by making $2x=y$, we obtain an equation in $y$ all whose co-efficients are *even* integers. The second point is not, however, so material as the first.

8. In what follows, I shall suppose that (4.) is the given equation, and that $a$, $b$, and $c$ are integers. This being premised, to solve (4.), we have the following

*Rule*

for the solution of the cubic,—

$$x^3+ax^2+bx+c=0.$$

(1.) Place the coefficient of $x^2$, the coefficient of $x$, and three times the absolute term, in a horizontal line, and in the order in which they have just been mentioned.

(2.) Multiply each of these quantities by the coefficient of $x^2$.

(3.) From the right band product subtract the square of the quantity at the top of the middle one.

(4.) From the middle product subtract three times the quantity at the top of the right hand column (*i. e.*, subtract $9c$).

(5.) From the left hand product subtract three times the quantity at the top of the middle column (*i. e.*, subtract $3b$.)

(6.) Divide the middle remainder by 2.

(7.) Of the three results thus obtained, multiply the right hand one by that on the left, and ADD to this product the square of the middle one.

[This resembles the operation which the combined effect of (2) and (3) performs on the original right hand quantity ($3c$), except that the square of the middle quantity is, in the present instance, *added* instead of subtracted. When the result of this *addition*, which, in the Examples, will be marked by obelisks (†), is positive, the equation has ONE real root, when negative, it has ALL its roots real.]

(8.) Find the square roots of the sum last obtained, and add them successively to the quantity at the bottom of the middle column.

(9.) Multiply the quantity at the bottom of the left hand column by the coefficient of $x^2$.

(10.) From the product subtract successively three times each of the results obtained in (8.)

(11.) Find the cube root of each of the results obtained in (10), and

(12.) Add them simultaneously to the coefficient of $x^2$; and one-third of the result, with its sign changed, will be a root of the given cubic.

The reader will do well to refer to p. 196 of vol. I. of the *Mathematician*, where he will find a somewhat different form which I have given to this Rule. Some numerical examples will serve to render the above more intelligible, and to fix it in the mind, and the reader will then be able to judge of its applicability to those cases where rigorous expressions are required.

*Example* 1.—Solve the equation

$$x^3-7x^2+17x-14=0.$$

Premising that

$$3\times 14=42,\text{ and }(17)^2=289,$$

the work, following the Rule, will stand as follows:—

$$\begin{array}{rcrcr}
-7 & \ldots\ldots & 17 & \ldots\ldots & -42\\
-7 & \ldots\ldots & -7 & \ldots\ldots & -7\\
\hline
49 & \ldots\ldots & -119 & \ldots\ldots & 294\\
51 & \ldots\ldots & -126 & \ldots\ldots & 289\\
\hline
 & & 2)\,7 & & \\
-2 & \ldots\ldots & 3{\cdot}5 & \ldots & 5\\
 & & & & -2\\
\hline
 & & & & -10\\
 & & & (3{\cdot}5)^2= & 12{\cdot}25\\
\hline
-7 & \ldots\ldots & \pm 1{\cdot}5 & \ldots & \dagger 2{\cdot}25\\
\hline
14 & & & & \\
15=3\times & & 5 & & \\
6=3\times & & 2 & & \\
\hline
\end{array}$$

$$\begin{array}{lcr}
-1 \text{ whose cube root} & = & -1\\
8 \ \ldots\ldots\ldots\ldots & = & 2\\
 & & -7\\
\hline
 & & 3)-6\\
\hline
 & & \therefore\ 2=x.
\end{array}$$

*Ex.* 2.—Solve the equation

$$x^3-6x^2+15x-14=0.$$

$$\begin{array}{rcrcr}
-6 & \ldots\ldots & 15 & \ldots\ldots & -42 \\
-6 & \ldots\ldots & -6 & \ldots\ldots & -6 \\
\hline
36 & \ldots\ldots & -90 & \ldots\ldots & 252 \\
45 & \ldots\ldots & -126 & \ldots\ldots & 225 \\
\hline
 & & 2)\,36 & & \\
-9 & & 18 & & 27 \\
 & & & & -9 \\
\hline
 & & & & -243 \\
-6 & & & & (18)^2=324 \\
\hline
54 & & \pm 9 & & \dagger 81 \\
81=3\times & & 27 & & \\
27=3\times & & 9 & & \\
\hline
\multicolumn{4}{l}{-27 \text{ whose cube root}=} & -3 \\
\multicolumn{4}{l}{27 \ldots\ldots\ldots\ldots =} & 3 \\
 & & & & -6 \\
\hline
 & & & & -6
\end{array}$$

whence, $x=2$.

In cases where the coefficients of the given cubic satisfy the relation $3ac=b^2$ the work will be almost entirely confined to the left-hand column. Thus, let it be required to solve the cubic,—

(*Ex.* 3.) $x^3-4x^2+6x-9=0.$

$$\begin{array}{rcr}
-4 & 6 & -9 \\
-4 & & -4 \\
\hline
16 & & 36 \\
18 & 6^2= & 36 \\
\hline
-2 & & 0 \\
-4 & & \\
\hline
8^* \text{ whose cube root} & & =2 \\
 & & -4 \\
\hline
 & & 6)6=1=x.
\end{array}$$

Up to the asterisk the work is the same as in the ordinary case. But the rest of the operation is this;—extract the cube root of the quantity marked with the asterisk; from this cube root subtract the coefficient of $x^2$; then the coefficient of $x$ divided by this difference will be the (only) real root of the given cubic.

*Ex.* 4.—I now proceed to consider a case in which the given cubic has *all* its roots real. Let

$$x^3-6x^2+11x-6=0$$

$$\begin{array}{rcr}
-6 & 11 & -18 \\
-6 & -6 & -6 \\
\hline
36 & -66 & 108 \\
33 & -54 & 121 \\
\hline
3 & 2)-12 & -13 \\
 & & 3 \\
\hline
-6 & -6 & -39 \\
 & & 36 \\
\hline
-18^* & & \dagger -3 \\
-18 & & \\
\hline
\end{array}$$

$$\begin{array}{lr}
+3\sqrt{-3} \text{ whose cube root}= & \sqrt[6]{-3}\,\sqrt[3]{3} \\
-3\sqrt{-3} \ldots\ldots\ldots\ldots = & -\sqrt[6]{-3}\,\sqrt[3]{3} \\
 & -6 \\
\hline
 & 3)-6 \\
\hline
 & -2
\end{array}$$

where, $x=2$.

Up to the asterisk the work is the same as in the rule above given. Arrived there, we subtract, from the quantity marked with an asterisk, three times the quantity at the bottom of the middle column. [In the present example the result of this subtraction is zero.] To the difference we add, successively, three times each of the square roots of the negative quantity corresponding to that marked with the *obelisk* (†), and we find the finite rigorous expression for the roots by adding the cube roots of the two sums, so obtained, to the coefficient of $x^2$, dividing the result by 3, and changing its sign.

But, even when the rigorous expression for the roots is not required, a portion of the above rule furnishes us, as I have above intimated, with the means of determining the nature of the roots of a cubic. I shall here give separately the process requisite for such a purpose.

### *On the Nature of the Roots of Cubic Equations.*

Supposing a given cubic reduced to the form above employed, (1) place the quantities $a$, $b$, and $3c$ in a horizontal row; (2) multiply the right-hand quantity by the left, and *subtract* from the product the square of the middle one; (3) multiply the middle quantity by the

left-hand one, and from the product subtract three times the right-hand quantity and *divide the result by* 2; (4) square the left-hand quantity and subtract from that square three times the middle quantity; (5) of the three quantities now at the bottom of the respective columns multiply the right-hand one by the left, and to the product ADD the square of the middle one, then, when the result is positive, the equation has only *one* real root; when negative, it has *three* real roots.

*Ex.* 5.—What is the nature of the roots of the equation

$$x^3+3x^2-6x-8=0\,?$$

| | | |
|---|---|---|
| 3 | −6 | −24 |
| 3 | 3 | 3 |
| 9 | −18 | −72 |
| −18 | −72 | 36 |
| 27 | 2)54 | −108 |
| | 27 | 27 |
| | 27 | |
| | | 756 |
| | 189 | 216 |
| | 54 | |
| | | −2916 |
| | | 729 |
| | | −2187 |

hence all the roots are *real;* they are respectively 2, −1, and −4. The above rules are readily committed to memory, and a little practice will render their application easy.

JAMES COCKLE.

2, Pump-court, Temple, May 13, 1850.

MR. GRUBB'S REGISTERED SPINDLE AND BEARING FOR THE DASHERS OF REVOLVING DASHER CHURNS.

(Registered under the Act for the Protection of Articles of Utility. Thomas Grubb, of Dublin, Civil Engineer, Inventor and Proprietor.)

Fig. 1 represents so much of this improved spindle as is new. A is a collar which (as also the part B) is truly turned. S is a square part made to fit into a square hole in an iron plate or washer attached to the dasher. Fig 2 is a front view, and fig. 3 a section of this improved bearing of metal or other substance; the parts which are marked A and B in figs. 2 and 3, being truly formed to fit those parts of fig. 1, respectively which are there marked A and B. VV, figs. 2 and 3, are pieces either cast with or attached, so as to form a dovetailed groove, into which the part shown by fig. 4 is fitted. Fig. 4 is a dovetailed slide,—a side view of which is shown at fig. 5. The part marked D is a projection, to allow of conveniently lifting the slide previous to removing the spindle, fig. 1.

Fig. 1.

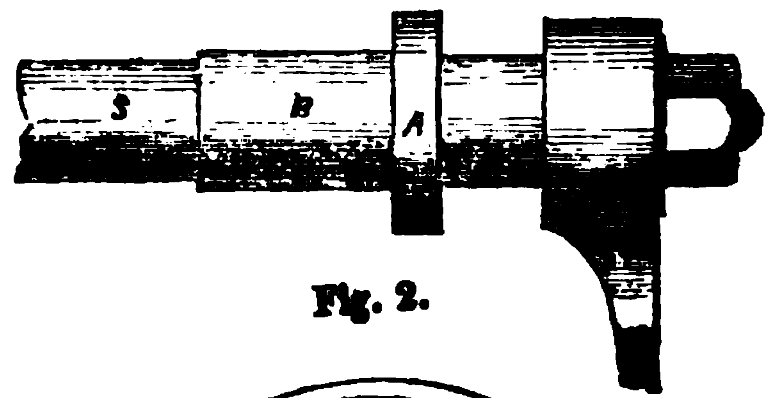


Fig. 2.

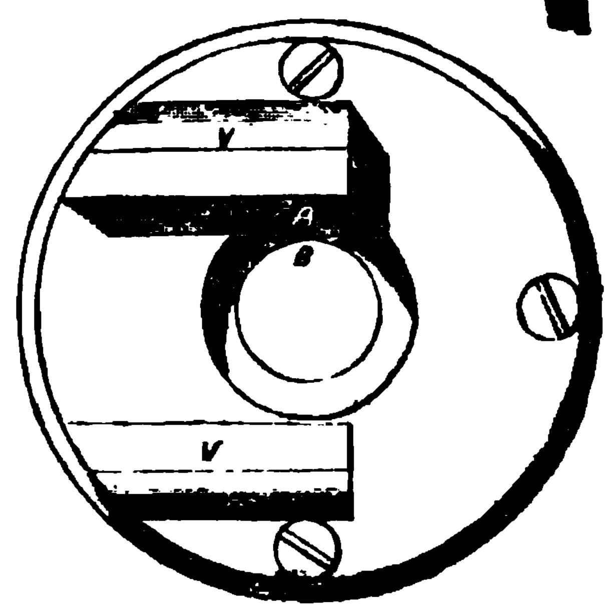


Fig. 3.

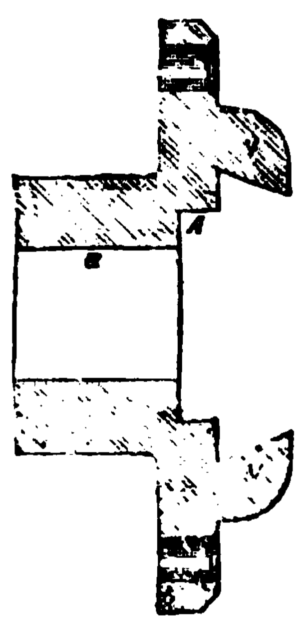


Fig. 4.

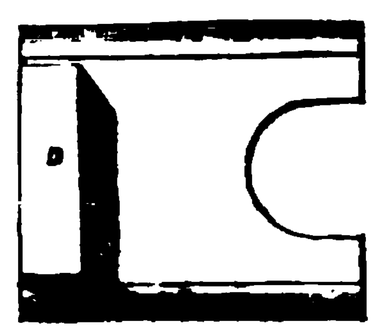
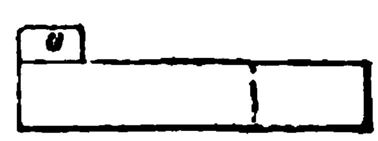


Fig. 5.



Mr. Grubb's improvements consist, therefore, firstly, in the spindle of the dasher being prevented, while in use, from moving endways by the shoulder between the parts A and B (fig. 3) on one side, and by the slide (fig. 4) on the other side; thus avoiding the necessity of adopting either of the present objectionable means of screwing the spindle

into the dasher, or of causing the spindle to pass through the opposite side of the churn. And, secondly, in the collar A acting in preventing any leakage from within, which prevention of leakage can be (if found desirable) made more perfect by introducing a collar of leather, or other suitable substance, between the collar A (fig. 1) and the shoulder between A and B (fig. 3).

## SUTTON'S ADJUSTABLE INKSTAND.

[Registered under the Act for the Protection of Articles of Utility. John Sutton, of 49, Stamford-street, Blackfriars-road, Surrey, Machinist, Proprietor.]

Fig. 1.

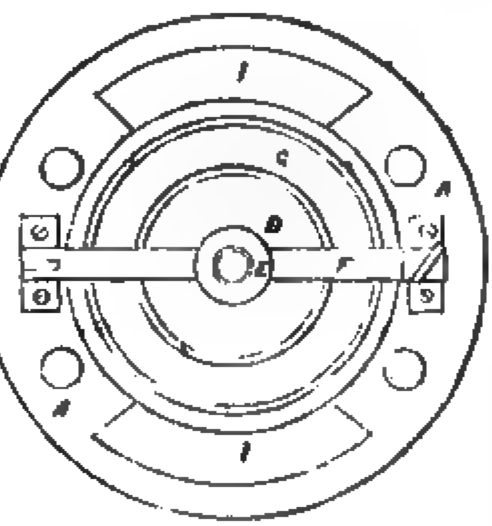


Fig. 2.

Fig. 1 a plan, and fig. 2, a vertical section of this inkstand. AA is a metal case, in the upper edge of which there is formed a cut or groove BB, by which the ribs of steel pens may be adjusted, so as to let the ink flow freely and uniformly from them. C is the glass or ink-holder; D is a disc or stage, made or faced on the upper surface with some soft and pliant surface, as gutta percha; this disc is capable of being raised up or lowered within the glass by means of the screw E, which is inserted into the bridge or cross-bar F, and is intended as a guard to prevent the pen being immersed too far into the ink; the screw E, affords a ready means of adjusting the disc to the proper depth in the fluid, and so to regulate the quantity of ink taken up; G is a circular brush which turns freely upon that part of the case marked $G^2$, as an axis, being held from coming off by the ring H; II are two slits formed in the top of the case, through which pens may be inserted in order to their being cleansed by means of the brush G.

## MR. BONNEY'S SAFETY YACHT.

On the 12th instant there was exhibited on the Serpentine, opposite the Royal Humane Society's Receiving-house, a yacht of very peculiar material and construction, the invention of Mr. W. W. Bonney, of Claremont Villa, St. John's, Fulham, who has registered the design. The dimensions, &c., of the vessel are as follow:—

Length, 15 ft. 6 ins.; breadth, 4 ft. 10 ins.; depth, 2 ft. 4 ins. Hull, clinker-built; planks of gutta percha (but the principle of formation will permit of the employment of other materials), cemented and copper-riveted together; the sides are doubled from the bilge upward to the spar deck, and are divided into water-tight compartments: the fore and aft parts of the boat are also divided into water-tight compartments, as in the outer gunwale. The keel and keelson are of iron; the latter is grooved to receive the ribs, and all are bolted together. The deck is double-laid, the upper diagonally with marine glue. The bilge timbers are deeper than usual, acting as extra keels; they, with the buoyancy of the outerwale, and the iron keel and keelson acting as counterpoise, render it next to impossible to capsize her.

All the anticipations formed, not only of her floating, but of her sailing capabilities, were fully realized. She was repeatedly filled with water; men in attendance got into her, and there being a very stiff breeze blowing, her powers

of resisting overturning were fully tested, and with complete success; for not only was she not waterlogged, but her rate of progression when filled was scarcely impeded, as compared with what would have been the case with a boat of ordinary construction; though, indeed, any such boat, under the circumstances, would have necessarily been wholly unmanageable and useless. From these experiments, it may safely be assumed that boats built on Mr. Bonney's plan cannot be sunk or capsized by accident, and scarcely intentionally; and this plan, it will be observed, is applicable to craft of all sizes, and of any external lines, so that boats already in use can have the principle of the safety yacht applied to them at a moderate expense. It would be difficult to exaggerate the importance of the extension of this discovery to life, fishing, and race boats; and we look for a speedy and extensive recognition of its merits at the hands of the Royal Yacht and other marine clubs.

On Saturday afternoon, the 15th inst., the following additional experiments were gone through, by the desire of some noblemen and gentlemen particularly interested in nautical matters, in order to test still farther the remarkable capabilities of this yacht:—

1. The yacht was hauled over, and so half filled with water; on being released, she righted immediately. She was then quite filled, and in that state she sailed and answered her helm well.

2. Two men sat upon the extreme end of her counter.

3. They then went forward; one (fifteen stone weight) stood upon her bowsprit, the other upon her stern.

4. They stood upon and overhung her gunwale.

5. They hung on from the mast-head, and hauled the mast-head, with sails set, under water; immediately on their releasing hold the boat righted.

6. She was lastly pressed down by the mast-head, with her sails set, till she was bottom upwards, and when the pressure was removed she righted.

## SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 19, 1850.

JOHN HOUGHTON CHRISTIE, Craven-street, Strand Middlesex, Esq. *For an improved construction of wrought iron wheels and machinery for effecting the same.* (A communication.) Patent dated 10th December, 1849.

Mr. Christie first takes a bar of rolled iron—its cross section being in the shape of an isoceles-triangle—and divides it into a number of equal sized prismatic blocks. These he arranges round a mandril, to form the hub of the wheel, with the bearing for the axle. The mandril is supported in a mould to form one face of the wheel. A bar of rolled iron is bent to form the tyre, and has its two ends smooth welded together. The tyre is placed in the mould, which contains in the space between the tyre and the kerb two concentric series of any suitable number of blocks. The series are kept together, when not in use, by the action of two separate sets of springs. A number of bars of rolled iron, bent into an L shape, are arranged in the mould with the elbow parts resting against and riveted to the interior periphery of the tyre, and the other ends between the prismatic blocks which are to constitute the kerb. A ram, or hammer, is worked up and down above the mould, and is provided on its under surface with wedges, which, at each descent of the ram, take into the space between the two concentric series of blocks, and drive the inner ones inwards and the outer one outwards; whereby the prismatic blocks, spokes and tyre—being previously heated to a welding heat—are welded together to form a complete wrought iron wheel ready for use, or, in the case for railway purposes, to receive the flanged tyre. This flanged tyre is stamped out of a bar of wrought iron in a manner similar to the process before described, with the exception that there is no inner series of rings, and that the mould is indented to form the flange.

*Claims.*—1. Making wheels of wrought iron, the parts composing which are heated to a welding heat, and then welded together by stamping.

2. The machinery or apparatus consisting of the mould, the blocks, springs, wedges, and mandril combined.

3. The machinery or apparatus (for making tyres) consisting of the mould, blocks, and wedges combined.

4. The general arrangement and combination of the different parts.

DAVID CHRISTIE, Salford, Lancaster, merchant. *For improvements in machinery for preparing, assorting, straightening, teasing, tearing, doubling, moistening, braid-*

*ing, and weaving cotton, wool and other fibrous substances.* (A communication.) Patent dated 10th December, 1849.

The patentee describes and claims :—

1. An improved cotton-gin.

2. Two arrangements of apparatus for preparing and assorting fibrous substances.

3. An arrangement and combination of apparatus for straightening the staple.

4. The coating or lining with metal that part of the harness of a loom or heddles through which the warp-threads pass.

5. A new stop motion.

JOHN HENRY JENKINSON, Salford, Lancashire, machine maker, and THOMAS PRIESTLY, Shuttleworth, Lancashire, manager. *For certain improvements in machinery or apparatus to be used for preparing, spinning, and doubling cotton, wool, flax, and similar fibrous materials.* Patent dated December 12, 1849.

The patentees describe and claim—

1. The application to the roller beam and top board of the carriage in mules, billies, and such like machines, of scavenging rollers, which remove the dirt therefrom, either simultaneously or successively. These rollers, which are both rotary, traversing, and oscillating, are attached to axles which turn in bearings in the upper and lower ends of several links which are free to slide up and down in slots, cut in a like number of brackets affixed to the lower part of the roller beam. The axles carry at one of their outer ends a pulley, and an endless strap is passed round them, so that the rotary motion of one will be imparted to the other, and consequently to its series of rollers. The slots are made (in one direction) rather larger than the links, in order to allow the rollers to oscillate slightly. The rollers are covered on their periphery with flannel or felt to collect the dust. Of course it will be understood that one of each pair of rollers is in front of the roller beam, while the other rests upon the top board of the carriage. As the carriage is moved back, one of the series of rollers will be made to revolve, by frictional contact, and communicate rotary motion by means of the endless band to the other series. On the carriage being moved in the reverse direction, the other series of rollers will revolve, and communicate rotary motion to the first in like manner. The result of the action of these rollers will be, the collection and removal of the dirt both from the roller beam and carriage board.

2. A mechanical arrangement for partially raising the finished cops up the spindles, instead of by hand, as has hitherto been the practice. It consists of a plate, provided with a number of slots corresponding to the number of spindles, or of a straight edge, which extends the whole length of the upper part of the carriage, and has affixed to the back part of it a rack. This rack gears into a pinion keyed on a rod, on which also is keyed the angle of a toothed sector that takes into an endless screw, which is turned by a winch handle. When the carriage is put up, the lower part of each of the spindles beneath the cop is embraced by three sides of its corresponding slot. The winch handle is then turned in the direction calculated to move the slotted plate upwards, whereby the cops will be partially raised up the spindles.

3. The application to the front rolls of preparing and dressing machines, of weights in the shape of rollers, covered with flannel, which consequently act as clearers, and, revolving with the rolls, diminish the friction.

4. An arrangement for stopping the working of a drawing machine when the sliver breaks. It consists of the ordinary trumpet, through which the sliver passes, and which is supported in the upper part of an elbow attached to a rod, the lower end of which is forked, and embraces a weighted lever in connection with the ordinary stop motion of the machine. The trumpet and rest of the apparatus are so nicely balanced, that the pressure of the sliver passing through it alone maintains it in a horizontal position; so that when the pressure is removed by the breakage of the sliver, the trumpet falls down and carries with it in its descent the weighted lever, which, through the intervention of connecting rods and levers, brings the ordinary stop motion into play, and arrests the further working of the machine.

5. The application to the wharves of spindles in preparing, spinning, and doubling machines, of friction pulleys composed of discs formed from a cylinder having tinned iron, or other tinned metal, spun or stamped all round.

ALFRED DALTON, West Bromwich, Stafford, ironfounder. *For improvements in reverberatory and other furnaces.* Patent dated December 15, 1849.

Mr. Dalton states that in reverberatory and other furnaces, in which air is admitted into the interior above the fire, a portion of the sides has been made of perforated fire brick, or stone, or of fire lumps, bricks, or stones, placed apart, and that through these perforations or spaces the air is admitted. But that, after being a short time in use, a portion of the crown or other part of the furnace becomes melted and runs down the side, which, together with the clinker, soon stops up the air passages. To remedy these evils, the patentee proposes

to recess or set back the sides through which the streams of air pass, in order that the melted substances may fall direct without running down the sides and choking the air passages. In the case of puddling and other furnaces, employed in heating and melting, iron plates of perforated iron, or iron bars, are to be substituted for the perforated bricks, or air passages, before described.

*Claims.*—1. The mode of constructing the fire places of furnaces wherein streams of air are admitted above the fire bars by recessing or setting back the sides through which the streams of air pass.

2. Constructing the sides of the fireplaces of puddling and other furnaces employed in heating or melting iron, through which streams of air are admitted, of perforated iron, or of iron in the form of bars.

3. Combining the arrangement of flues, shown in the drawings [but not referred to in the specification,] with the use of perforated iron plates, or iron in the form of bars.

Charles Lezars, Paris, civil engineer. *For improvements in gas meters.* (Being a communication.) Patent dated December 15, 1849.

The patentee describes a mode of arranging the diaphragms in dry gas meters, and also a mode of arranging and working the rotary valve. But as he merely designates the different parts by letters of reference, and omits to specify their mode of working and relation to each other, we are unable to lay before our readers anything like an intelligible account of his invention.

Timothy Hackworth, and John Wesley Hackworth, Soho Works, Shelden, Durham, engineer. *For improvements in locomotives and other engines.* Patent dated December 15, 1849.

The patentees describe and claim,

1. An arrangement for varying the lead and traverse of the valve independently of each other at the will of the engineman, by working the lead of each cylinder from its cross-head, and the traverse from that of the other cylinder. In the case of single-cylinder engines, the same result is obtained by the employment of additional gearing.

2. Obtaining a long stroke from a short stroke cylinder in locomotive engines by adapting to the cross-head an arm, which is connected by a link to a lever working outside, and attached at its lower end to a pin on the driving wheel.

3. Making the fire-box cylindrical on all sides except at top, which is flat, as is also the top of the boiler, for the purpose of carrying coke; the whole being surrounded by a hand-rail, or wire sides, to prevent the coke from falling off. The water reservoir is carried on the engine itself, with a space between it and the boiler. The waste steam is to be pumped into the reservoir.

Isaac Lewis Pulvermacher, Vienna, engineer. *For improvements in galvanic batteries, in electric telegraphs, and in electro-magnetic and magnetic-electric machines.* Patent dated December 15, 1849.

*Claims.*—1. Making galvanic batteries to revolve.

2. In respect to galvanic batteries, the use of half porous and half glazed diaphragms, a rotative action by which the plates or electrometers are dipped into or lifted out of the acids (more or less) at pleasure, a mode of entirely emptying the apparatus of the nitric acid when requisite; a hollow axis or axes, pipe and reservoir, by which the nitrous acid fumes are carried off and collected, and certain electro-magnets and parts in immediate connection therewith, whereby the electric current is maintained at nearly one uniform strength; as also an apparatus for increasing or diminishing the resistance to be overcome by such revolving batteries.

3. Certain modifications of the revolving galvanic battery.

4. A revolving battery, in so far as regards the employment of three fluids, of which one (the concentrated sulphuric acid) is used to prevent the two others (the nitric acid and dilute sulphuric acid) from mixing, and the arrangements by which such separation is effected; and also certain modifications of the said three fluid battery.

5. A self-supplying revolving battery, and a modification thereof, in so far as regards certain mechanical arrangements by which the expansion or reduction of the strength of the current generated by the battery is made to be itself the means of obtaining a fresh supply of the necessary elements.

6. The employment in galvanic batteries of diaphragms and cones composed of graphite, made plastic by pulverization, and mixture with bituminous substances; also a particular form of graphite diaphragm, and a diaphragm partly composed of plastic graphite and partly of glass or porcelain.

7. Certain hydro-voltaic chain batteries, in so far as respects the arrangement by which every link is made to constitute of itself a separate and distinct battery having a positive and negative electro-motor; and also the combination therewith of moderators and indicators.

8. Three several modes of changing the direction of electric currents; that is to say, *firstly*—The regulation of the changes

of the poles in such manner that between each change and that which follows next, the power of the current shall gradually increase from a minimum to a maximum, and then in the gradual manner decline from a maximum to a minimum, at which last point (alone) the change takes place; *secondly*—The producing of the changes in two or more parts of magnetic conductors, by means of a single apparatus, and in such manner that, whilst the current in one conductor is gradually increasing in power, that in the other is gradually diminishing, and the change of direction is produced at the moment when the diminishing current attains to its minimum; and, *thirdly*—The mode of producing the change of power by either gradually increasing the surfaces of the electrometers in the case of moveable batteries, or by the successive introduction (in the case of stationary batteries) into the electric currents of resisting bodies.

9. An electro-magnetic arrangement for the production of mechanical power; that is to say, in so far as regards the combination of a single galvanic battery with two cylinders covered with electro-magnets, and the enveloping or connecting these magnets, the whole or part of them, by coils of conducting wires, and the other parts in immediate and necessary connection therewith; also a modification of the said arrangement wherein three or more cylinders, covered with electro-magnets as aforesaid, are used instead of two.

10. A governor for regulating the degrees of immersion of the electometers into the exciting fluids.

11. An electro-magnetic motive engine, in the general arrangement and construction of parts of which the same consists, and more especially in respect of a method by which a continuous and unintermittent action is produced from two sets of electro-magnets, and the necessity for a fly-wheel thus dispensed with.

12. A magneto-electric rotary engine; also a modification thereof, wherein three flat plates are employed as the magnets.

13. Certain improvements in electric telegraphs; that is to say, in so far as regards, *firstly*—A method of varying the intensity of the current, either by increasing or diminishing the number of elements employed, or by interposing more or less powerful resistants to the current; *secondly*—The imprinting letters or signs by one completion of the current; *thirdly*—The substitution of a letter cylinder for the letter wheel ordinarily employed, and a method of arranging the letters and signs on such cylinder; *fourthly*—The application of double escapements, each capable of assuming four directions, and each producing effects different from those produced by the others; *fifthly*—The employment of four electro-magnets to act on two soft iron bars, and thereby render a weak galvanic current available in two directions, and productive of two separate and distinct effects; and *sixthly*—The method of gradually detaching the keeper from the electro-magnet, by causing the springs which act upon the keeper to come only successively into operation.

14. A flat arrangement of electro-magnets.

THOMAS ROCK SHUTE, Watford, Hertford, silk throwster. *For improvements in spinning, doubling, and throwing organzine silk.* Patent dated December 15, 1849.

This invention consists in passing the ends of two yarns of raw silk from their bobbins (the spindles of which are driven in the usual way) through an apparatus, which formed the subject of a former patent granted to Mr. Shute, for equalising the tension of both yarns, and cutting one in case of the other breaking, thence round a bent glass rod and between two rollers, the bottom one of which is grooved and roughened on its circumference, and the other coated with a band of vulcanised caoütchouc. The roughed wheel is keyed on the axle of a toothed wheel, whereby rotary motion is communicated to it in the ordinary manner. The circumferences of the two wheels are kept in contact by the resiliency of a helical spring, the ends of which are attached to the respective bearings of the wheels. The top roller is carried by a projecting piece which is capable of being moved up to allow of the silk being withdrawn from between the two rollers. The object of this arrangement is to draw the silk at a speed regulated by that of the grooved wheel. The silk after it issues from between the rollers, passes over a second bent glass rod, and thence to a flyer, which winds it on to a bobbin.

*Claim.*—The application of the wheel coated on its periphery with vulcanised caoutchouc in combination with the grooved and roughened wheel and spring.

RICHARD HOBSON, Leeds, York, M.D. *For certain improvements in the manufacture of horse-shoes, and in apparatus for taking the measurement of horse-shoes or horse's hoofs.* Patent dated December 15, 1849.

The patentee describes and claims:

A measuring apparatus which consists of a graduated disc having a projection, with a clip underneath, at one end, and at the opposite end a slotted bar. The disc carries at the centre a revolving strip of metal, which is graduated on its top surface, begin-

ning at the axle, into inches and sixteenths of an inch. The divisions of the disc are marked A, B, &c. The slotted bar carries a cross plate, which may be fixed in any convenient position by a set screw, and which is graduated on each side of the screw. The plate is furnished on the under side with a clip. When the measure is to be taken, this instrument is placed in the shoe or hoof, and the plate pushed up and screwed down so as to clip it. The slip of metal is then brought all round, and the groom or smith reads off the distances of the outline of the hoof or shoe, at the divisions, from the centre of the disc. These distances are noted down on a steel plate graduated to correspond to the disc by the insertion of pins into holes at the divisions. These marks are transferred to a block of steel, which the workman chamfers away to form the mould for the disc. When the mould and die are completed, they are placed in a stamping-machine.

The shoes are stamped out of bars of iron rolled with a succession of V grooves, having solid portions between each two to form the fullering. The solid portions are intended to form the toes and heels of the shoes. The bars are also rolled with flanges, portions of which are to be cut away, and the remaining pieces turned to form the clips. The holes are punched in the fullering of the shoes after they are stamped.

Henry Roberts, Connaught-square, Hyde-park, gentlemen. *For improvements in the manufacture of bricks and tiles.* Patent dated December 15, 1849.

These improvements consist in making hollow bricks or tiles according to the ordinary mode of manufacturing such articles, with the exception that one of the sides of each is made with a square or a rebated joint, to admit of their being bonded together without headers and without vertical joints, so that they present the external appearance of an ordinary structure, and oppose an obstacle to or effectually prevent the passage of moisture through the mortar.

*Claim.*—The manufacture of bricks and tiles whether hollow or otherwise, of the forms represented in the drawings, suitable for obtaining good bonding without headers, and for avoiding vertical joints which pass directly through the wall, as explained.

James Oldknow, of Lille, in France, lace manufacturer. *For improvements in the manufacture of lace and other fabrics.* December 15, 1849.

Thes improvements relate to the construction of warp bars and guide bars for warp frame machinery. The warp bars are bored or punched by means of guides or perforated plates applied to the drills or punches employed, so that the poles in the warping bars may correspond with the guide bars. The improvement in the guide bars consists in soldering or riveting on pieces of wire, with a hooked or perforated termination, upon the guide bar, to form the eyes, instead of cutting the eyes out of the metal of the guide bar itself.

*Claims.*—1. The improved method of boring the warp bars of twist-lace machinery, as also the employment of perforated plates in place of the *stump bars* now employed; and also the employment of brackets for the warp bars.

2. The improved method of forming the guide bars.

Charles Cowper, of Southampton-buildings, Chancery-lane. *For improvements in instruments for measuring, indicating, aud regulating the pressure of air, steam, and other fluids; and in instruments for measuring, indicating, and regulating the temperature of the same, and in instruments for obtaining motive power from the same.* Patent dated December 15, 1849.

These improvements are based upon the action resulting from the effect of a change of temperature upon bent tubes by means of air or other fluids contained in them. The interior or bore of the tubes is to be of any form excepting the circular.

*Claim.*—The method of indicating the temperature and pressure of fluids by means of the changes effected upon bent tubes of any form in cross section except a circular.

Jonah Davies and George Davies, of the Albion Iron Foundry, Tipton, Staffordshire, engineers and ironfounders. *For improvements in engines worked by steam, air, water, and other fluids, and whether locomotive, marine, or stationary; and also in boilers; the principle of which improvements is likewise applicable to blowing air and pumping water.* Patent dated December 10, 1849.

The patentee describes and claims—

1. Certain improvements in the disc engine of peculiar construction.

2. A peculiar construction of steam boilers with two sets of tubes, by which the products of combustion are made to pass through one set to the further end of the furnace, and to return to the front end through the second set of tubes.

William Birkmyre, Falbeck Cottage Hampstead, Chemist. *For improvements in the manufacture and refining of sugar.* Patent dated December 12, 1849.

The object of this invention is chiefly to render insoluble the colouring matter of cane-juice and syrups of raw sugar, by precipitating in these liquids a small quantity of alumina by lime, chalk, or limestone

either from sulphate of alumina or from sulphate of alumina and silica, or silex (this last named compound being the product of the action of sulphuric acid and heat upon China or pipe clays).

The compound of sulphuric acid, alumina, and silex is obtained by adding an equal weight of sulphuric acid—if it be of the sp. gr. 1·847—to dry China or pipeclay, either of which consisting almost entirely of alumina and silex, and then heating the mixture to about 700° Fahr., when every 100 parts of the dry, common, China clay of commerce become 175 parts. In this way the sulphuric acid and the alumina form a salt, which is as near as possible a sulphate of alumina with free silex; in some parts of this country the above compound can be made for less than 4*l.* per ton, and while it contains no soluble substance that is not precipitated by lime or chalk, it has the further advantage of yielding double the quantity of alumina to be found in the alum of commerce.

The patentee states that the best mode of applying to cane-juice and syrups of raw sugar the sulphate of alumina, either by itself or with silex, is as follows:—

*Clarifying and decolorizing of cane-juice.*—To every 100 imperial gallons of unskimmed concentrated cane-juice, previously treated either with or without lime (temper), of the density 1·200, or 40° of Twaddell's hydrometer, and of the ordinary colour, there ought to be added, by degrees, 25 lbs. of a mixture consisting of 14 lbs. ground sulphate of alumina and silex, and 11 lbs. ground chalk. Upon the addition of these bodies, there immediately ensues an effervescence from the escape of carbonic acid, and simultaneously with it a precipitate of alumina with the colouring matter. After boiling for a few minutes, the whole contents of the pan ought then to be passed through bag filters, of the construction well known in this country by the name of Schroeder's filters. The purified juice should now be concentrated either in an open or the vacuum pan; if the former pan be used, the juice should be brought up to the temperature 239° Fahr., and struck at once into cones of iron or earthenware capable of holding about 60 lbs. of the juice. On standing twenty-four hours, they should be once liquored with strong syrup. By proceeding thus the sugar is obtained of a good colour, and cured in much less time than by the ordinary process of making Lisbon sugar in the Brazils or Cuba, and the serious average loss of 10 per cent. saccharine matter, by drainage and fermentation on shipboard from British colonies, completely avoided. As more than half the colouring matter has been abstracted from the juice by the alumina, while the filtration has withdrawn all the insoluble matter, a sugar is produced which gives a clear solution, and is free of the sediment which appears in dissolving ordinary Muscovadoes.

The sediment in the bags should be first washed with weak but hot juice, and then with water. The washed sediment (consisting of alumina with colouring matter and other impurities of the cane juice, sulphate of lime, and silex, with a small excess of chalk,) may be used as a fertilizer, or converted by heat into a species of charcoal, fit for decolourizing cane juice or syrups.

When the pure sulphate of alumina is used, 11 lbs. of finely ground chalk should be thrown alternately into the 100 imperial gallons of concentrated cane juice with 9 lbs. of sulphate of alumina, either in powder or solution. The sulphate of alumina and chalk in the above proportion are equally as powerful as the mixture of 25 lbs. of sulphate of alumina, silex, and chalk.

*Refining of Raw Sugar.*—For every cwt. of Muscoavdo sugar dissolved in the clarifiers (blow ups), there is to be added by degrees, and alternately, 2 lbs. of finely ground chalk, and the like quantity of sulphate of alumina, to the hot syrup of the usual strength of 27° of the saccharometer, or 47½° Twaddell's hydrometer. As the sulphate of alumina is very soluble in water, it may be more convenient in some instances to add it in solution; for this purpose it should be dissolved in an adjoining vessel, and every gallon of the solution of specific gravity 1·150 or 30° Twaddell's hydrometer, contains almost exactly 2 lbs. of sulphate of alumina. This syrup should be brought near the boiling point, and kept there for a few minutes, and if steam be the heating agent of the clarifiers, the apparent boiling point of 203° Fahr., produced by high-pressure steam will be quite high enough. The steam is now to be turned off, and the whole contents allowed to settle for a few minutes, after which they should be allowed to pass into the bag filters. The filtered liquor may now be passed into the charcoal cistern, or at once evaporated in an open or vacuum pan, then crystallized, poured into moulds, brushed off, and syruped in the usual way. When as much as possible of the strong syrup has gone through the filters, they should be washed by passing boiling hot water through them, and the weak syrup pumped into the clarifier for dissolving more sugar. In this way it is found that the alumina completely dispenses with blood (spice) and at the same time abstracts from the raw sugar at least

one-half of the colouring matter, and thereby dispenses with one-half of the animal charcoal. If no blood nor animal charcoal be used, the refined sugar produced from raw sugar, and that from cane juice in the mode just described, retain an agreeable smell.

The process of manufacturing and refining sugar, which has been described, may be varied by using lime alone with sulphate of alumina in the syrups, or by using various proportions of lime with chalk or limestone.

*Claims.*—1. The decolorizing of cane juice and syrups of raw sugar by adding to them a mixture of pounded chalk or limestone, and the substance (sulphate of alumina and silex) derived from the action of sulphuric acid and heat upon China or pipe clays.

2. The decolorizing of cane juice and syrups of raw sugar by precipitating alumina in the cane juice and syrups, from sulphate of alumina by lime, or ground chalk, or limestone, or by a mixture of lime with chalk or limestone.

3. The use of the substance formed in the cane juice, or of raw sugar syrups, by the action of lime, chalk, or limestone upon sulphate of alumina and silex; or of lime, chalk, or limestone upon sulphate of alumina without the silex.

Robert Harcourt, Birmingham, manufacturer. *For certain improvements in knobs, handles, and fastenings for doors and drawers, and in fastenings to be used in fastening window-sashes, curtain and other rods, and for other like purposes.* Patent dated December 15, 1849.

The patentee describes and claims—

1. Making knobs without stems, but with sockets projecting inside to receive the spindle, and both of larger diameter than usual to avoid breakage.

2. Tapping a male and female screw on the spindle and in the socket respectively, to admit of the length of the handle being increased or diminished to suit different-sized doors.

3. Making the spindle of *oven* or cupboard handles square, with a thread cut on the edges to take into a hollow provided in the catch for that purpose, which is fitted with a set screw, so that when the spindle and catch are screwed up tight enough, they may be prevented from shifting by turning the screw, and thereby causing it to press against the flat surface of the spindle.

4. A sash-fastener, which consists of two parts, one containing a screw which carries at bottom a small lever, the outer end of which is nicked to take into a projection inside the other part. When the sash is to be opened, the lever is lowered by turning the screw in one direction, so as to allow the nick to slide over the projection. When the sash is to be fastened, the lever is screwed up close to the tops of the two parts, to prevent the lever being depressed and the nick from sliding over the projection.

5. Passing one end of the rod into a socket closed at one end, and inserting the other end of the rod into two semicircular halves, which are hinged together. This end is kept down by an eye.

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*Specifications Due, but not Enrolled.*

George Wythes, Reigate, Surrey, contractor. *For improvements in apparatus for receiving and retaining the rails of railways.* Patent dated December 15, 1849.

Benjamin Fawcett, Old Jewry, builder. *For improvements in pigments, paints, and vehicles for painting.* Patent dated December 15, 1849.

## RECENT AMERICAN PATENTS.

(Selected from the Reports in the *Franklin Journal.*)

For an Improvement in Winnowing Machines. *John W. Fisk.*

The nature of these improvements consists in giving to the second separating riddle and screen, rocking, vertical, and longitudinal motions (the screen having in addition thereto a shoveling motion), the riddle being curved and presenting its concavity upwards, and the screen being in an incline sufficient, when moved, to have a tendency to deliver the heavy grain on the apron leading to the back part of the machine, while the heavy cheat falls through into the division in front of the apron, and the remnant of light cheat is blown over its front edge, and falls into a division in front of the last-mentioned receptacle.

Another part of the invention consists in curving the riddle aforementioned, and turning its concavity upwards, so as to give the blast of air produced by the fan a full sweep through the load, from its bottom to its top, as it lies on the riddle.

Another part of the invention consists in hanging the screen to the second separating or concave riddle firmly, and in such wise that their front parts shall end in the same vertical plane, while the screen shall project rearwards one-fifth, more or less, of its entire length beyond the rear of the riddle.

Another part of the invention consists in deriving the vertical and vibrating motions of the feeder, chaff riddle, apron, and first separating riddle, from the mechanism which gives the vertical, longitudinal,

and rocking motion to the second separating or concave riddle and screen.

*Claims.*—1. Giving rocking, vertical, and longitudinal motions to the lowest or second separating and curved riddle and screen pendant thereto, by means of a mover and guide, curved, attached, and supported as described, or any equivalent device operated in an equivalent manner.

2. The second separating or lowest riddle, having its concavity upwards.

3. Deriving the vertical and vibrating motions given to the feeder, chaff riddle, apron, and first separating riddle, from the mover and guide of the second separating and curved riddle and screen.

FOR AN IMPROVEMENT IN CIRCULAR SAW MILLS. *David Philips.*

*Claims.*—1. Making the plate of the saw in sections, whose inner angle rests upon the shaft and is secured to the rings and collar, the radial edges of adjacent sections being separated from each other far enough to admit of the free expansion of the metal from heat without meeting, but connected by means which do not prevent this expansion, whereby the warping or buckling which invariably occur in solid plates, or those whose sections are in contact from partial heating, is effectually prevented, while at same time the compound sectional plate, thus arranged, possesses sufficient strength and firmness for all practical purposes.

2. A method of preventing and arresting the vibrations in the saw plate, by causing it to pass between cushions, bristles, or other elastic surfaces arranged.

FOR AN IMPROVEMENT IN MILLS FOR GRINDING. *Thomas A. Chandler.*

The nature of this invention consists in combining a series of two or more grinding cylinders, running at unequal velocities, and vibrating in a direction parallel to their axes, and with equal or unequal and opposite motions, these rollers being placed nearly in contact, in order that grain passed between them may be crushed and rubbed in opposite ways at the same time, and thus be uniform and finely pulverized by the least possible contact with the grinding surfaces; the grinding cylinders, which are hollow, being kept cool by the circulation of a current of air through them, which is kept flowing by the action of oblique openings in their ends, those of one end being inclined in the contrary direction to those of the other, in order that one set of openings may favour the entry, and the other the escape of the air.

*Claims.*—1. The combination of two or more revolving oscillating cylinders, arranged and operated, for the purpose of grinding grain and other substances.

2. The manner hereindescribed, of preventing the cylinders and journals of their axes from becoming unduly heated, by keeping a constant current of air circulating through them by the action of the oblique lips of the radial apertures in their ends.

FOR AN IMPROVEMENT IN SUN-DIALS. *James Scott.*

This invention consists in combining with the gnomon a small pin, wire, or shadow indicator, and a scale to indicate, by means of the shadow of such a pin or indicator, the month and day of the month; whereby the dial may not only be made to indicate the time of the day, but also the day of the year: that is to say, the month and day of the month.

*Claim.*—The shadow indicator or pin, and declination scale, or scale of months and days, in combination with the gnomon, substantially in the manner and for the purpose as specified.

FOR AN IMPROVED STEERING APPARATUS. *Jesse Reed.*

The essential and distinguishing feature of this newly-invented steering wheel is a revolving right and left-threaded screw, working two half nuts on opposite sides of said screw, said nuts being connected to the two sides of the rudder head; and as the nuts move always in opposite directions, on opposite sides of said revolving screw, they both tend to give the rudder a rotary motion in the same direction.

*Claim.*—The combination of a right and left-threaded screw, on the hand wheel shaft, with two half nuts, arranged one on each side of said screw, and traversing in guides opposite to each other, as herein above set forth, said nuts being connected to the rudder head, either by the long arms, as in the first described arrangement, or as in the second, by the slotted arms and sliding buttons, all arranged and operating substantially as set forth.

FOR AN IMPROVEMENT IN STEAM PIPES FOR SUGAR BOILING. *Alfred Stillman.*

*Claim.*—Connecting the two compartments of the main steam pipe of the evaporating tubes of evaporating pans, by means of a series of syphon tubes, which receive the steam from one compartment and discharge it into the lower compartment, whereby I am enabled to obtain a larger amount of heating surface than by any other known plan.

## WEEKLY LIST OF NEW ENGLISH PATENTS.

Charles Lamport, of Wortrington, Cumberland, shipbuilder, for certain improvements in machinery or apparatus for lifting and moving weights, working chains, and pumping, which improvements are more especially adapted to ship use. June 19; six months.

Charles Greenway, of Green-street, Grosvenor-

square, Middlesex, for improvements in ships' and other pumps, in anchors, and in propelling vessels. June 19; six months.

Benjamin Cheverton, of Camden-street, Camden-town, Middlesex, artist, for methods of imitating ivory and bone. June 19; six months.

Charles Hanson, of Stepney, Middlesex, engineer, for certain improvements in steam engines, steam boilers, and safety valves, and in apparatus and machinery for propelling vessels. June 19; six months.

Isaac Hartas, of Wretton Hall, York, farmer, for improvements in machinery for obtaining motive power. (Being a communication). June 19; six months.

Robert Heath, of Manchester, iron merchant, and Richard Hendley Thomas, of Woolstanton, Stafford, engineer, for certain improvements in the manufacture of iron. June 19; six months.

Ethan Baldwin, of Philadelphia, Pennsylvania, United States of America, for a new and useful method of generating and applying steam in propelling vessels, locomotives, and stationary machinery. June 19; six months.

Robert Weare, of Angel-court, Throgmorton-street, clock and watch manufacturer, for certain improvements in the means and apparatus for extinguishing fire, and in galvanic batteries. June 19; six months.

George Robarts, of Tavistock, Devon, gentleman, for certain improvements in clogs and pattens. June 19; two months.

Gaspard Malo, of Dunkirk, France, shipowner, for certain improvements in propelling vessels. June 20; six months.

William Saunders, of the firm of Randell and Saunders, of Bath, Somerset, stone merchants, for improvements in sawing and sawing machinery. June 20; six months.

John Hunt, of Stratford, Essex, engineer, for improvements in forming and moulding plastic substances, and the machinery and apparatus employed therein. June 20; six months.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| Date of Registration. | No. in the Register. | Proprietors' Names. | Addresses. | Subjects of Design. |
|---|---|---|---|---|
| June 13 | 2335 | George Baddeley | 521, Oxford-street | Boot. |
| ,, | 2336 | William Pilbeam | Acton-street, Gray's-inn-road | Smoke-preventing chimney pot. |
| 14 | 2337 | Richard Robinson | The Eliza-street Works, Belfast | Compound bar furnace. |
| ,, | 2338 | Charles Burton | Trowbridge | Elastic mauler for a weaver' harness. |
| 17 | 2339 | William Bird | Oxford-street | Boot. |
| ,, | 2340 | Frederick and Charles Huxham, and James Armitage Brown | Exeter, Devonshire | Driving motion for hand-mills. |
| ,, | 2341 | Ann Remington | Shaftesbury Crescent, Pimlico | Self-acting baster and vertical heat reflector for roasting. |
| ,, | 2342 | Taylor Henry and Co. | White Lion-street, Spital-square | Imperial disinfecting filter. |
| 20 | 2343 | Philip Le Capelain, the Elder | Long Acre | Portable oven. |

CONTENTS OF THIS NUMBER.



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# Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1403.] SATURDAY, JUNE 29, 1850. [Price 3*d*., Stamped, 4*d*.

Edited by J. C. Robertson, 166, Fleet-street.


## BERTHON'S PERPETUAL LOG, OR SPEED AND LEE-WAY INDICATOR.

Fig. 1. Fig. 2.

Fig. 4. Fig. 5. Fig. 7.

Fig. 3'.

Fig. 5a.

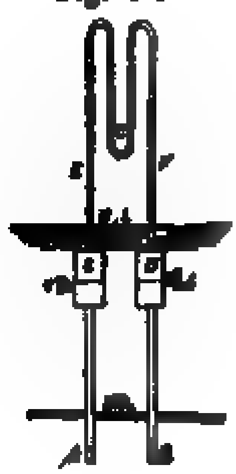
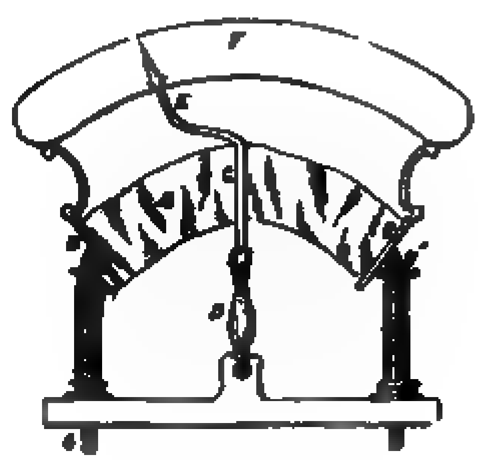


Fig. 6.



## BERTHON'S PERPETUAL LOG, OR SPEED AND LEE-WAY INDICATOR.

(Patent dated December 19, 1849. Patentee, Rev. Edward Lyon Berthon, M.A., Fareham, Hants. Specification enrolled June 19, 1850.)

The principle of this instrument is the same as that on which Pitot's well-known hydrometer is constructed, and registers the speed of ships or currents by the height of column raised by resistance.

In all former attempts of this kind, the result has been only approximative, having been subject to several disturbing causes, for which an allowance was necessary, such as draught of water, trim, list, and the action of the sea. But in the Berthon "Perpetual Log," all disturbing causes are perfectly and continually neutralized. It will be easily perceived that, if a simple and single column of water, depending upon the resistance, be used to indicate speed, the height of that column in the ship will vary, not only as a function of the velocity, but *also as the immersion varies;* and this will depend not merely on the draught, but likewise on the trim and inclination of the vessel. In theory, this difficulty has been got over by Capt. Belcher, Mr. Scott Russell, and others, by using a sliding scale, to be set according to the draught of water at the time; but in practice, the difficulty remained, as the inventor of the present instrument found, when desirous of obtaining any correct indications in bad weather.

The continual correction or compensation in the patent "perpetual log" is effected by the discovery and adoption of the inventor of other forces besides the *positive* or elevating force due to velocity.

Using a small brass tube, closed at bottom, and having a small aperture near the lower end, he found that, by turning the axis of this aperture in different directions, different forces were obtained, *negative* as well as *positive.*

Thus, let figs. 1, 2, 3, and 4 represent a transverse section of the tube (turned in various directions), cut through the aperture or port, which tube works in a hollow socket or sheath placed vertically in the ship's bottom.

Fig. 1.

Fig. 2.

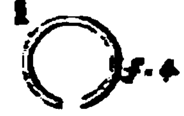


Fig. 3.

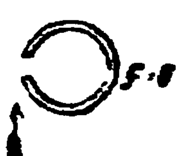
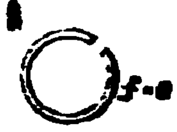


Fig. 4.



The motion is supposed to be in the direction of the arrow, with an uniform speed of (say) rather less than 10 knots per hour. The aperture, turned forward as in fig. 1, produces a positive force, raising the water *four* feet above the sea level turned aft, as in fig. 2, it is a *negative* force, depressing the water four feet *below* the level. Turned towards the beam, or at right angles to the line of motion, as in fig. 3, though it might be supposed that this being half-way between +4 and −4, would be a *zero* point; yet such is not the case; for *it is the greatest of all the negative forces,* and depresses the water six feet. The true zero point, with a round port, is at the angle 41° 30′ with the line of motion, and with a rectangular fine-edged port at 58°*

The much-desired compensation is effected by using any two of the above forces, made to act upon the two ends or surfaces of a column of mercury in a bent tube: the diagram (fig. 5) will explain their action. For instance, let A and B be two tubes projecting a few inches below the ship's bottom, closed below. A has an aperture, of which the axis of the port, is in the line of motion; B's port, is at 41° 30′. C is an air-vessel communicating with A—and D a similar one with B. W L is the water line; B S the bottom of the ship; C and F are two air-pipes connected with the air-vessels respectively, and fastened to the two ends of the bent glass tube G, which is half filled with mercury. Now when the ship is at rest, if the small air valves *c* and *d* be opened to let the air escape, the water will rise to these points in the two air vessels C and D, compressing the air above; if, now, the air valves be closed, the pressure in these air vessels will be always equal; and consequently, the pressure conveyed along the air pipes E and F will affect two surfaces of the mercury equally, whatever be the immersion. Let us call this pressure upwards the *statical* force, and the pressure resulting from resistance the *dynamical* force—then, whatever be the direction of the ports of the tube, the statical forces will always be

* The preceding results were obtained with a rectangular aperture with fine edges.

equal in the two air vessels, whether in motion or at rest; but not so the dynamical force, which acts at A, but not at B, because the port of B is at the zero point. The consequence is, that when in motion, the pressure is increased in the air vessel C, but not in D, which depresses the surface of the mercury in the tube, and raises the other to heights varying as the squares of the velocities; and thus all *vertical* forces are compensated or eliminated, and the horizontal one alone is registered. In practice the two tubes are conducted into one, which is divided into two distinct chambers. This double tube, called the "way tube," passes through a stuffing-box, stopcock, and sheath, into the water, and is furnished with a water vane of peculiar construction, which not only keeps the ports in the *right direction*, but also performs another important function to be afterwads described. The connections between the chambers of the way tube and their respective air vessels is by means of flexible hose. On the top of the way tube is a shackle, and above it a rod, which extends to any desired point above, where there is a horizontal segment of a circle engraved with points of the compass and degrees of the circle: upon the rod is an index needle, which is moved with the rod and way tube by the vane below, and indicates the exact course or direction in which the ship is moving. There is a handle on the same rod for drawing the way tube into the sheath when coming into shoal water.

Having given this general account of the invention, we shall now proceed to lay before our readers the more circumstantial description given by Mr. Berthon himself in his specification:—

*Description.*

Fig. 1 is a representation, partly in section and partly in elevation, of the instrument for indicating the velocity of a ship or other vessel. A A is a metal tube fixed into the bottom of the ship in board, by screwing it into one of the bottom plates, if the ship be of iron, or if of wood, fixed by a flange to the timber. In wooden ships, it is best to insert the tube through the kelson and keel, and prolong it downwards to the under side. In iron ships, it should descend alongside the keel, extending down nearly to its lower edge. This tube A A is furnished with a stopcock $a$, and a little above that with a stuffing box $a^1$. The bore of the tube is about three-quarters of an inch, more or less; and the hole through the plug of the stopcock $a$ is of the same diameter. B B is a brass tube, called the "way tube," which fits into and passes down through the fixed tube A A into the water, and when in use projects a few inches downwards. A view of the way tube, as it appears when withdrawn from the fixed tube A A, is given separately in fig. 2. It is divided into an upper chamber $b$ and a lower chamber $b^1$ by a diaphragm $d$ inserted at about an inch from the lower end. From the lower chamber $b^1$ a small pipe $g, g, g, g$, passes upwards through the upper chamber $b$, and projects out at the top through a metal cross head H. Another short piece of pipe $g''$ also projects through the cross head at the top from the upper chamber $b$. In one side of this way tube there are three ports or holes $c'$, $c''$, $c'''$, open to the water, of about one-eighth of an inch each in diameter—one of these ports ($c^1$) being near to the bottom of the upper chamber $b$, and the other two ($c''$ $c'''$) in the lower chamber, and the three ports being so placed in relation to each other that the axes of the holes $c''$ $c'''$ shall respectively stand at an angle of about 42° with the axis of the port $c'$. The lower chamber $b^1$ is closed by a metal plug C soldered in, which has a forked tail piece (P) three-quarters of an inch long. Between the branches of this fork is swivelled the small end of a vane D (more particularly delineated in fig. 3), which works with a vertical joint on a pin $e$ passed through it and the two branches of the fork. A side elevation of the vane D is given separately in fig. 3, and a plan of it in fig. $3^1$. V V are two slips of hard brass, about one-twelfth of an inch thick, and five-eighths of an inch wide, and from eight to twelve inches long, which are curved out laterally till their outer ends stand about one inch and a half apart, and are connected by a piece of thin India-rubber $f$, like the web of a duck's foot. When these two slips are pressed together by hand, they readily collapse and pass through the stuffing-box $a^1$ and stopcock $a$ of the tube A A, and when in the water below they expand again and extend the web. G, fig. 2 is a shackle, which receives the two ends of the cross head H upon the top of the way tube; and from the top of this shackle a rod K is carried upwards to any convenient spot vertically over it, which rod terminates in a handle L (fig. 1); immediatbly below the handle L there is an index pointer $m$, which moves horizontally over an arc of a circle (about 120°), which is graduated into points of the compass and degrees of the circle; $C^1$ $C^2$ (fig. 1) are two pieces of flexible hose which connect the short pipes $g$ and $g''$ of the way tube with fixed pipes E E, $E^1$ $E^1$. F $F^1$ are two air vessels of about three or four inches in diameter, which are placed in-board below the water line, and furnished with stopcocks $f f^1$ and small air valves $v v^1$; these

air valves respectively communicate with the two fixed pipes E E, $E^1$ $E^1$ below, and also with two air pipes above G G, $G^1$ $G^1$, which last are connected by two pieces of hose H $H^1$ (in manner to be afterwards described) to the two tubes (Q R) of a mercurial indicator, a section of which is given separately in fig. 4. M is a wooden frame piece, which is slung on the joint P (or it may be fixed). To this frame piece are affixed the two glass tubes Q R, one in front and the other behind; the back tube Q is small, and has a bulb N near the bottom, while the front tube is about one-quarter of an inch bore, and communicates with the bulb N by a fine bent capilliary tube. The flexible hoses H $H^1$ are first passed over the ends of these tubes with solution of India-rubber, and then made taut by lashing. To the front of the frame piece M there is attached a scale of ivory, metal, wood, or other suitable material (graduated to represent nautical miles and tenths of miles per hour). The first mile is indicated by the decimal ·04 of an inch, the second ·16, the third ·36, the fourth ·64, the fifth *one* inch, and so on increasing as the square of the velocities.

The action of the instrument is as follows:—The way tube is pushed through the tubular case A A till its lower end dips a few inches into the water. Then, by opening the air valves $v$ $v^1$ of the air vessels, to let some of the air escape, the water enters through the chambers of the way tube, and rises through the pipes $C^1$ $C^1$, $C^2$ $C^2$, E E, $E^1$ $E^1$ as high as the air valves, which must then be closed. When the ship is at rest the air is compressed equally by the water in the two air vessels, and communicates the same equal pressure to the two surfaces of the mercury in the indicator, and, of course, keeps the same steady. But when the ship moves through the water there is an increase of pressure in the air vessel F, because the port of the upper chamber of the way tube, with which F is connected, is in a direct line with the line of motion, and an elevating force proportional to the resistance is then produced, which lifts the whole column of water at once. But there is no increase of pressure in $F^1$, because the two ports of the lower chamber connected with it stand at angles of about 42° with the line of motion, at which angle there is no increase of pressure or elevating force arising from resistance. Consequently the excess of pressure in F, communicated to the mercury through the air inclosed in the air pipe G G, causes the mercury to descend in the bulb behind the indicator, and pass up the tube in the front of it, when the mark on the scale against which its surface stands denotes the speed of the ship at the time.

The course of a vessel may be ascertained by the instrument in this way. When the ship is at rest, the vane D hangs down, but when it moves, the resistance of the water raises it to the horizontal position, and the pressure against its sides keeps it always in a direct line behind the tube, effecting the twofold purpose of keeping the ports of the chambers in the right direction, and also by moving the rod K K, and the index finger *n* on it, it indicates the course or direction of the ship upon the horizontal dial.

The draught of water, again, may be thus ascertained. Whereas the ports of the lower chamber of the way tube, placed at an angle of about 42° on either side, produce no change of pressure resulting from velocity, it follows that the pressure in the air vessel $F^1$ varies only as the draught of water varies, and therefore a small bent tube S, half filled with mercury, of which one end is connected with the air tube $G^1$, and the other end open, will show, by the elevation of the mercury against a scale graduated to represent feet and inches, the draught of water at the time of observation.

Another form of indicator, which may be substituted for the one above described, is shown in fig. 6.

A is a tube of thin vulcanized India-rubber, attached and sealed at each end to two discs of metal B B, which are attached by air-tight joints to the two air tubes G $G^1$, as in fig. 1. This elastic tube is very slightly extended, and is divided into two distinct parts by a metal diaphragm C. D is a radius or lever, which grasps the diaphragm, and moves with it about its centre or fulcrum. From this lever there projects an index finger E, which moves over a vertical arc F, graduated to correspond with nautical miles. The action of this indicator is as follows:—When the ship is at rest, the diaphragm is pressed by equal forces, and therefore does not move; but when the vessel moves, the diaphragm being pressed on one side more than the other, is forced over, and, carrying the index finger with it, marks the speed of the ship on the graduated arc.

A third form of indicator is shown in fig. 7. Here the glass is furnished with two conical bulbs, *a* and *b*, which contain mercury; and upon the mercury in *a* is superimposed some coloured water, spirit, or oil, and just enough to fill it when the ship is at rest. By combining these two fluids of different specific gravities, an approximate equalization of the marks on the scale for the knots per hour is obtained, making the low speeds more conspicuous.

The way tube before described is constructed on the principle of combining the positive or elevating force with a zero one, but by altering the angles at which the ports of the

chambers stand with respect to the line of motion, several other combinations may be obtained, as, for example, the difference between two positive, two negative, or the sum of a negative and a positive force, remembering in this last case that the two forces act upon the opposite surfaces of the mercury.

For instance, one port forward and the other aft, would double the range, because when right aft, the negative or drawing force is equal to the positive or pressing one, the scale being adjusted to the peculiar combination.

It must, however, be borne in mind that the great use of using two forces instead of one, is, that thereby all disturbances arising from change of draught of water, list or trim, or the action of the sea, are neutralized or compensated.

To indicate the mean velocity of ships for a considerable time, two large vertical pipes, a few inches in diameter, may be made to communicate with the two air vessels respectively; that connected with F on the pressure side should be five or six feet long, or more in fast vessels. These pipes may be placed in any convenient spot, with their lower ends on a level with the air vessels. If, then, the stopcocks be a very little opened, much time must elapse before any considerable change of height of water in the pipes is produced, consequently the height of the mercury, which corresponds with that of the water, will be a mean height.

Any of the instruments before described, exposed to a current of water in the direction of its motion, will indicate the speed of such current.

[The "Clinometer" of Mr. Berthon, which is also included in the same patent, will be described in a future Number.]

## PRINCIPLES OF PERSPECTIVE.

Last year, in the *Art Journal* for September, there appeared the first of a series of three articles on Perspective. The second was published in the part for Nov. and the third in that for February of the present year. The writer of those articles is a Mr. Herdman, of Liverpool, an artist, and he has propounded a system which he complacently recommends to his professional brethren as the standard by which they ought to regulate their practice. A conception of its peculiarities may be obtained from the following theorems which are the most remarkable of its fundamental novelties.

"A plane passing through the eye becomes a right line, called a vanishing line."

"A plane parallel to its vanishing plane is *convex* in appearance. Its convexity increases in proportion to its distance from its vanishing plane to 90°, *or the arc of a circle*, and it terminates in its vanishing plane."

"A parallel line is a line parallel to any right line passing by the eye and is convex in appearance according to its distance from the line of the eye to the arc of a circle."

The *Art Journal* itself would be the most appropriate place in which to demonstrate the incorrectness of these theorems, but its conductors are averse to inserting communications of a controversial character. Since, however, the students of pictorial art may be misled by the dissemination of false principles of perspective, I think that Mr. Herdman's error should be exposed; more especially as they derive plausibility from the pseudo-scientific character which he has given to them. In enunciating his propositions he has assumed the air of a professor capable of unbounded research, and he insists on his readers taking very extensive views of things. He requires them to see not only all that part of every line which can possibly be seen, but also to trace it in imagination till it vanish in the horizon at *two* points diametrically opposite to each other. An infinite straight line, not passing through the observer's eye, would unquestionably so seem to vanish; for its projection on the apparent celestial sphere would form the semi-circumference of a great circle. It may, therefore, be inferred that the projections on that sphere of all finite straight lines, (including, of course, rectilineal representations of such lines) if not directed towards the observer's eye, will form smaller arcs of great circles; but, because the observer's eye must be in the plane of such circles, it is a mistake to suppose that every line will have, in appearance, a degree of curvature dependent on its elevation above the horizontal plane.

Satisfied with the comprehensiveness of his survey, Mr. Herdman ventures to affirm, that "it appears to have been an

error of perspective that its laws as a science only commence with the picture." Now, after thus insinuating against all preceding writers on the subject, a charge of having improperly circumscribed their views, he has himself as egregiously erred. He has altogether overlooked, as if it were a matter of no importance, the nature of the surface on which the picture is to be made. Surely the forms, directions, and relative magnitudes of the lines, representing an object on any surface, must be modified by the form of that surface. His "record" of the discoveries, which he congratulated himself on having made, clearly shows that he has only conceived a vague and imperfect idea of the manner in which lines would be seen projected on the concave surface of a sphere by a spectator stationed at its centre. That he is ignorant of the right interpretation of his own observations I infer from his not having recommended spherical surfaces as suitable for pictorial purposes. For the same reason I presume he acquiesces in the continued use of flat ones; they are obviously the most convenient and, consequently, the science of linear perspective has hitherto been limited to the establishing of rules by which the appearance of the forms of natural objects, regarded from a determined point, may be represented on them. This being the sole aim of the science, I shall now proceed to show that its accepted fundamental theorems rest on irrefragable evidence. The subjoined definitions constitute the basis of my reasoning.

*Definition* 1. A plane or flat surface is a surface such that if any two points whatever be taken in it and a straight line be drawn between them, the straight line will be wholly in that surface.

*Def.* 2. Parallel straight lines are straight lines which lie in the same plane, and which can never meet though they be infinitely produced in either direction.

*Def.* 3. A straight line is parallel to a plane when it can never meet the plane, though it and the plane be extended infinitely either way in the direction of the line.

*Def.* 4. Parallel planes are planes so placed, with regard to each other, that they can never meet though they be infinitely extended in all directions.

I also adopt the following assumptions without the formality of demonstration.

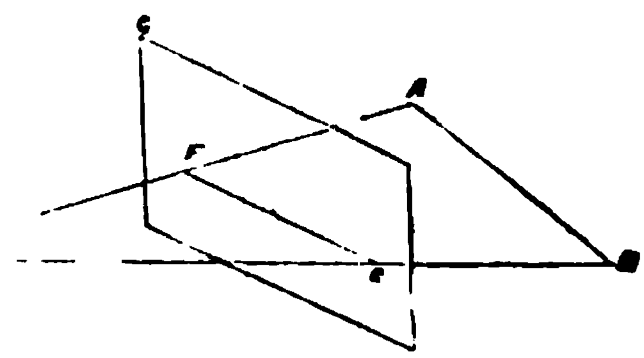
*Assumption* 1. A plane may be applied to a straight line, so that the straight line shall be wholly in that plane.

*Assump.* 2. If two straight lines be both parallel to a third, not in the same plane that they are in, they will be parallel to each other. (*Euclid* XI. 9.)

*Assumption* 3. Rays of light proceed from the various points of visible objects to the eye of a spectator in straight lines.

*Proposition* 1. The perspective representation, on a plane, of a straight line which is not directed towards the eye of the spectator, is a straight line.

Let AB be a straight line, CD a plane on which it is to be represented; suppose this plane to be transparent, and let E be the place of the spectator's eye.



Then, since the rays of light proceeding from the points A and B to E will describe straight lines, as AE and BE, cutting the plane CD in the points F and G, if between these two points there be drawn in the plane CD a *straight line* FG, it will be the perspective representation of AB. For, let a plane be applied to AB, so that AB may be wholly in it (*Assump.* 1); and, let it be turned round AB, as if hinged thereto, till it pass through the point E, then the lines AE and BE will both also be in it. And because the point E is in that plane, and also every point in AB, any number of straight lines drawn from as many points in AB must also be in it; wherefore, all the rays of light proceeding from the line AB towards E must proceed in that plane, and must pass through the plane CD in the straight line FG; for FG is not only in the plane CD, but also in that in which the rays of light proceed towards E, because the points F and G are. Now, a perfect view of an object can only be obtained by moving the eye, so that rays of light proceeding from every point of the object may be successively received on the centre of the retina, through the lenses of the eye in a line coincident with their axis; con-

sequently, to obtain a perfect view of AB, the eye must be so revolved, that the axis of the lenses shall be moved in the plane of the triangle AEB and successively occupy every direction between EA and EB. This being the case, if the rays of light proceeding from AB towards the eye at E were to be arrested before their arrival at FG, and the eye were to be impressed with rays from FG, the appearance of FG would be similar to that of AB; for to obtain a perfect view of FG the axis of the lenses of the eye would still have to be moved in the plane of the triangle AEB, so as to occupy successively every direction between EA and EB; therefore the straight line FG is the perspective image of AB.

*Corollary* 1. The intersection of two planes is a straight line.

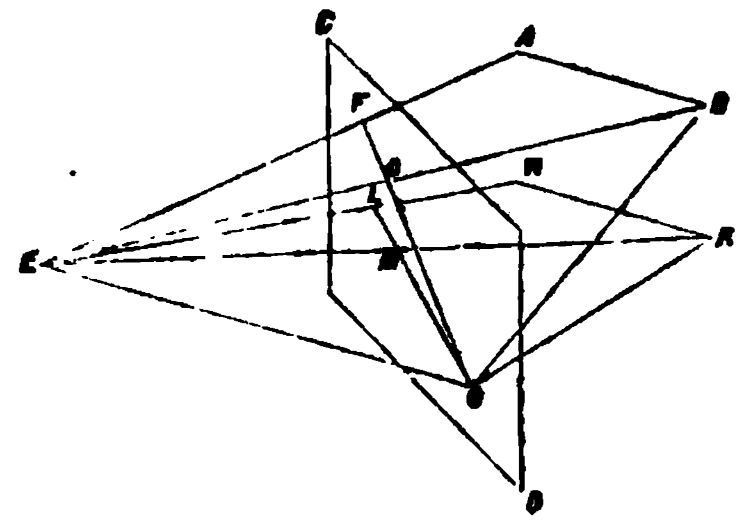
*Cor*. 2. In viewing a rectilineal angle the axis of the lenses of the eye will first be moved in the plane passing through the centre of the retina and one of the lines forming the angle, till it be directed towards the angular point; from that situation it will be moved in the plane which passes through the centre of the retina and the other line.

*Cor*. 3. In viewing a curve which does not lie in a plane passing through the centre of the retina, the axis of the lenses of the eye will be moved in a curved surface.

*Remark*. It seems probable that our idea of the form of any object, acquired by means of vision, results from a consciousness of the muscular efforts made in disposing the eye to receive luminous impressions from the various parts of it. If this conjecture be correct, there is a closer connection than Mr. Herdman imagines between the properties of lines and figures discussed abstractly in geometry and the properties of similar lines and figures visible in nature.

*Prop*. 2. If two straight lines be parallel to each other, and likewise to the plane on which they are to be represented, their perspective representations will be parallel straight lines.

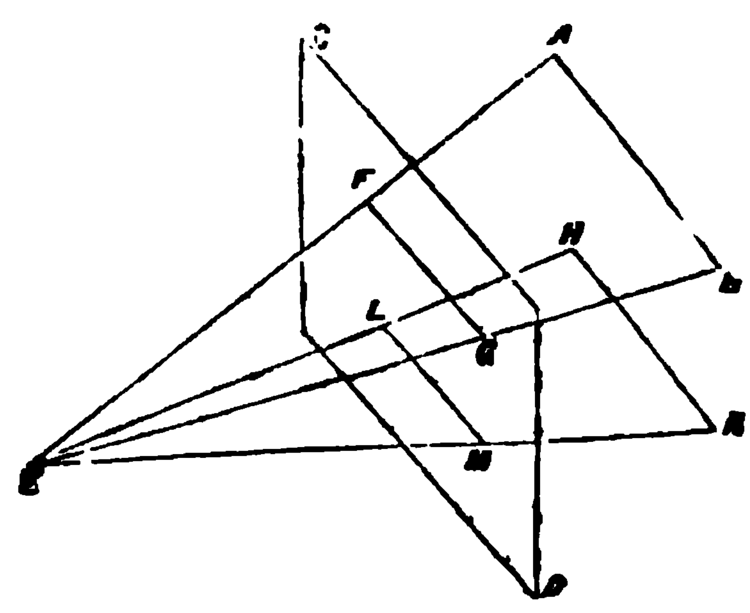
Let AB and HK be two straight lines parallel to each other, and also the plane CD, and let E be the place of the spectator's eye; then by *Prop*. 1, FG and LM will be the perspective representations of AB HK. Now, FG will be parallel to AB, for if it be not, since both lines be in the plane AEB, they will meet in some point if pro-



duced; but if they meet, AB must also meet the plane CD, for FG, though produced infinitely must lie wholly in that plane as well as in that plane AEB; but by the supposition, AB is parallel to the plane CD, and therefore cannot meet it; consequently FG and AB cannot meet, that is, they are parallel (*Def*. 2.) Similarly it may be proved that LM is parallel to HK. And because FG and HK are both parallel to AB; FG is therefore parallel to HK (*Assump*. 2), and because FG and LM are both parallel to HK, FG is parallel to LM.

*Prop*. 3. The perspective representation of straight lines parallel to each other, but not parallel to the plane on which they are to be represented, will converge towards the point where this plane is cut by a straight line drawn from the eye of the spectator parallel to any of the lines to be represented.

Let AB and HK be two straight lines parallel to each other, but not parallel to the plane on which they are to be represented.



Let E be the place of the spectator's eye, and EO a straight line drawn from E parallel to AB, and cutting the plane

CD in O; the perspective representations AB and HK will converge towards O. Let F be the point in which EA cuts the plane CD and L, that in which EH cuts it; join FO and LO. Then, because EO and AB are parallel they are in the same plane, namely, AEOB (*Def.* 2) and because HK is parallel to AB, EO is parallel to HK (*Assump.* 2), therefore EO and HK are in the same plane, namely, HEOK. Now, if EB be joined, the straight line EB will be in the plane AEOB, and, as EA is also in it, the point F in EA must be in it, and the point O being likewise in it: therefore, also the line joining FO will be in it. But FO will likewise be in the plane CD; wherefore FG, that portion of it intercepted between EA and EB will be the perspective representation of AB (*Prop.* 1). Similarly, it may be proved that LM, a part of LO will be the perspective representation of HK; hence, the truth of the proposition is obvious.

I have endeavoured to make the demonstrations of the foregoing propositions rigorous, and yet intelligible to readers who know no more of geometry than the meaning of a few of the terms most frequently used. It appears to me that if artists were well satisfied of the truth of these propositions, a system such as that advocated by Mr Herdman would never obtain from them more than a cursory notice. There would be no danger of its shaking their faith in the rules by which they have, till now, been guided. They would be certain that by those rules they could produce a picture of any proposed scene, so that, beheld from the one proper point of view, it should be, with respect to form, an exact resemblance. More than this cannot be accomplished; and not even by a gentleman having such a genius for discovering "new things" as Mr. Herdman has.

If it be admitted that I have established my first proposition, then must Mr. Herdman's doctrine relative to the curved appearance of straight lines be rejected and the rules of practice which he has suggested be avoided as worthless. In (*Prop.* 2) I have attempted to elucidate that principle which, according to his rash assertion, renders the Science of Linear Perspective, in its present state, inconsistent. For instance, if we have to represent the front of a row of buildings of uniform height on a parallel plane, it is obvious from this proposition that the representation must also be made of uniform height. The visual angles subtended by the height of the row at different places will certainly be different, but the visual *angles subtended by the height of the representation at the corresponding places will differ in a like ratio*.

Mr. Herdman will probably still refer to the pictures produced by the camera as undeniable proofs of the soundness of his notions. That he has however only failed to detect the real cause of the sensible curvature in these images of straight lines which are at a distance from the centre of such pictures is very manifest. If a camera be constructed, having for the admission of the light a small hole without a lense, the pictures obtained by its means, though somewhat indistinctly, will be in strict conformity with the rules which he has had the temerity to assail.

JOSEPH BURNE.

Exeter, June 12, 1850.

## ANALYSIS OF THE EVIDENCE GIVEN BY THE WITNESSES EXAMINED BY THE COMMISSIONERS APPOINTED TO INQUIRE INTO THE APPLICATION OF IRON TO RAILWAY STRUCTURES.

(Concluded from page 348.)

*Joseph Locke, Esq., M.P.*, civil engineer. —946. The strength of iron will depend upon mixtures.—948. Prefers a mixture.—949. The mixture of hot blast iron with cold blast considerably increases the strength. Understands that a mixture of wrought iron with cast adds to its strength.—950. Considers it better to trust to the knowledge and experience of iron founders of high character than to specify for particular mixtures.—952. Has generally made the breaking weight of girders from three to four times the greatest load; but the load is supposed to be dead weight, whereas the shocks in railway bridges may increase it to within half the breaking weight.—955. On railways from the levels the most convenient form of girder must sometimes be adopted in preference to the stiffest.—956. Would not prove a girder with more than double the greatest load.—958. Thinks dead weight a more self-evident mode of proving girders, but that the hydraulic press is a very convenient and good mode.—963. Resting the weight on one of the bottom

flanges produces torsion to some extent.—964. Thinks it might be desirable in some instances to test the girders with weights applied as in practice.—965. Has known cases where the test was applied to one flange as in railway practice.—967. Never knew a flange break off a girder.—969. To prevent the girders getting out of the perpendicular, makes the baulks supporting the rails fit tight between the girders, and connects the bottom flanges by tie rods.—972. Has never observed any injury arise to girders from being subjected to permanent weights for a length of time, or to changes of temperature.—974. Would allow girders on railway bridges to deflect from the 30th of an inch to the 40th of an inch per foot linear. — 975. But the amount would depend on the form of the girder.—977. Some forms admit of more deflections. —978. Does not like too much deflection in a railway beam.—981. For the forms of girders adopts the large bottom flange.—984. According to his present experience, would limit cast iron girders in one piece to 45 feet long, but he may perhaps go further. —986. Would always prefer an arch if possible.—987. Dislikes cast iron in flat girders at all times and in all spans. Would never use it if he could avoid it.—988. Does not object so much to wrought iron, but would not use that when it could be avoided.—991. Is not favourable to girders combined of separate pieces.—992. Would use the bow string bridge for large spans.—994. Does not approve of combining wrought and cast iron as done in girders of the Dee Bridge class. —995. But does not wish it to be inferred that there is no combination of which he would approve.—1000. Objects chiefly on account of the different rates of expansion of wrought and cast iron.—1003. Does not think that in compound bridges well put together the vibration and impact from trains would affect the joints and rivets; but if badly put together, or the roadway were not not in good order, the joints would sooner or later be affected.—1005, 1006. Does not consider that the deflection of one girder before that of the other in skew bridges would produce oscillation to any injurious extent.—1013. When the roadway is good there is very little difference between the deflection due to weights at rest and that due to the weights moving with velocity. A bad joint is much more serious than an increase of velocity. Has known the deflection to be less with velocity. When there is any great difference, attributes it to bad joints. — 1015. Conceives that perpetual concussions might change the texture of wrought iron.—1016. Does not think the same effect would be produced in cast iron. —1017. A cast iron beam which had been in use for a long time in the Blackwall Railway was taken out and broken; it bore a very large weight with reference to its calculated breaking weight.—1019. Would observe that axles broke more frequently when crank axles were in use.—1021. The fractures he has seen appeared to be the work of time.—1024. Has seen nothing in the fractures to induce him to believe they were the result of a change of structure.—1027. Considers one ton per foot in length as the greatest weight that comes on railways; is opposed to increasing the weight of engines. 1032. Thinks the plan of having wrought iron box girders a very sound one.—1033. They have been long in use for steam engines; prefers them in moderate spans to cast iron.—1038. Would never employ a flat girder unless compelled to do so. The effect of the vibration of trains, however slight, is ultimately to separate the parts, while in an arch the parts are always clinging faster together; if a general rule is to be adopted, let it be in favour of the arch.

*Charles H. Wild, Esq.*, civil engineer.—1077. In testing the compound girders for the bridge over the Ombrone, an initial strain of five tons per square inch of section was put upon the wrought iron ties; by the adjusting pieces, any amount of initial strain can be put on the ties.—1079. By that means the beam can be cambered.—1080. If, in compound girders, the ties are applied in a neutral state, they are of very little practical use.—1081. The ties have an initial strain put upon them, but does not believe that any change will take place in the ties to require re-adjustment. —1082. If the strain put upon them is far within the limits of elasticity, they will retain that strain.—1083. If an extension of the ties were likely to take place, this sort of bridge should be given up.—1085. The ties being strong enough to allow for extra weight to come upon them, will never require to be adjusted after being put up. The bridge over the Arno is of compound girders, with the ties lying horizontally along the bottom flange. The ties are in four pieces, and adjusted to the required initial strain by means of gibs and keys at the junctions.—1086. This bridge was tested by taking out the dowels connecting the castings, and allowing the whole strain to come on the tension rods. If the ties are put on in a neutral state, the elongation when the weight comes on is so small that the strain would only be about 1½ ton per inch; the initial strain can be so adjusted that the tie can take the whole of the tensile strain of the girder, or half, or any portion.—1087. The bridge is 96 feet span, and was tested

with 40 tons in the centre, trusting entirely to the ties.—1092. Has experimented on compound girders with the tie, and when the tie was removed.—1095. And has found the stiffness increase with the amount of initial strain put upon the ties.—1098. In breaking compound girders, never saw the bolts give way; no strain can come upon them so long as the joints do not open.—1099. Looks upon the dowels and bolts as only useful during the course of erection.—1100. Would not like to test the Arno girder without the tie, but thinks the bolts and dowels might be taken away without interfering with the strength.—1102. In an experimental girder made for the tie to be adjusted, either horizontally or at an angle, like in the Dee Bridge, it was found to be almost equally efficacious in three different positions, viz., when the ends were, 1st, higher than the top flange of the girder; 2nd, level with the top flange; 3rd, horizontal. — 1104. The effect of the difference between the extreme cold of winter and extreme heat of summer would be to add about half a ton per square inch to the existing strain upon the tie.—1106. The usual effect of the tie, when the girder is bearing a load, depends on its area, upon the strain upon it per square inch, and upon its depth below the centre of compression; hence, if the ends of the girder come in so exactly to counterbalance the extension of the lower part of the girder (a point never reached in practice), if there were an initial strain on the tie, it would still be doing useful work.—1108. It is a popular fallacy that there is a disadvantage in having the ends of the ties above the top flange; the raised ties give greater facility for putting on the initial strain than the horizontal ones. The initial strain is measured by means of an instrument called an extensometer, fixed on to the tie bar, which shows the actual amount the bar is extended; and having found the rate at which similar iron extends with certain weights per square inch of section, the strain on the bars due to the extension is known.—1109. The higher the tie is put the less increase of strain comes on it from the passing load.—1110. Has never known the tie slacken.—1111. Does not consider that a wrought iron bar cast into the bottom flange of a girder is a good method, as no initial strain can be put on it. If, by means of the weight, the bar was extended the $\frac{1}{1000}$th of its length, there would be a strain on it of ten tons per square inch, but has never known them extended beyond $\frac{1}{4000}$th; hence the strain would only be $2\frac{1}{2}$ tons per square inch.—1113. The cast iron would break before the tie was doing much work. The above forms of trussed girder are the only ones that have been adopted.—1114. Would have the platform of a bridge firmly united to the girders, and sufficiently deep to prevent any twisting in the main girders. The bearers for the platform in the Arno bridge are Sandwich girders.—1115. Mr. Stephenson is using strips of wrought iron, with timber between, for purlins for roofs.—1116. They are very stiff.

*Thomas Cubitt, Esq.*, builder.—1120. Has found variations in the same description of iron; experiments by different persons do not give corresponding results from similiar makes of iron. Does not trust to experiments made on a small scale.—1121. The quality of iron is only affected by the hot or cold blast so far as materials unfavourable to the production of good pig iron are present. Care should be exercised in the selection of hot blast iron.—1122. Makes girders strong enough to bear three times the greatest load that could come upon them; these girders are for buildings.—1123. Proves girders by the hydraulic press; proves them to double the greatest load that could come upon them, or 2-3rds the breaking weight. From the liability of girders to internal flaws, would rather prove a girder nearly to the extent that would break it than not prove it at all.—1124. In buildings, the weight is more frequently placed on the bottom than on the top flange, but has never thought it of importance to apply the proof weight to the bottom flange.—1125. The deflection of a girder depends on the shape, section, and quality of metal. In two girders, the length of one being double the length of the other, but the section and depth being constant, the longest girder would deflect four times as much as the other. Considers the stiffest iron best for steady weight.—1126. Weigthed a girder with a load equal to 2-3rds of its breaking weight, and left it on for 36 hours; the deflection did not increase, and the permanent set was not more than that which had been observed after the first application of the weight.—1127. Makes the area of the top flange to the bottom one as 1 to $3\frac{1}{2}$ or 4. The bottom flange is equal in width to about half the greatest depth of the girder; diminishes the depth of the girder at the ends to about half the depth in the centre; considers it of great importance not to do anything which would tend to make the girder unsound when cast, or cause unequal strains in cooling. Shoes or sockets tend to create flaws, by allowing dirt and sand to accumulate, and prevent the equal flow of metal. It does not follow that the theoretical form of greatest strength is the best one to adopt.—1129. His attention has been principally confined to beams sub-

jected to weights at rest.—1130. As weight in such castings is not of so much importance, he is guided in the selection of irons by the market price.—1131. Always mixes irons; is inclined to think that good will result from Mr. Morries Sterling's endeavours to increase the strength of iron by an admixture of wrought iron.—1133. Thinks the manufacture of iron below the other manufactures of the country; believes that in France they roll out bars heavier than we do.—1135. Thinks that, if the plan adopted in Belgium of manufacturers exhibiting qualities of iron every year were followed it would improve the manufacture.—1140. Considers that the quality of iron depends, first, upon the raw material, then on the fuel and care in manufacture.—1141. Thinks investigation into the manufacture of iron desirable, and that it would be advantageous to offer premiums for the best iron.

*Isambard Kingdon Brunel, Esq.*, civil engineer.—1147. Has a preference for the Welch and Staffordshire irons.—1148. Endeavours to obtain a small proportion of hot-blast iron in mixtures.—1152. Does not like a large proportion of hot-blasts thinks 1-5th advantageous.—1154. Takes the greatest possible load that can by any accident come upon a girder, and assumes that as 1-3rd or 2-5ths of the breaking weight; but takes the breaking point lower than it is generally taken.—1155. As a general rule, would prove a girder with a load a little greater than the greatest that could come upon it, and examines its appearance under that load.—1156. Actual weight is the preferable mode of testing girders.—1158. Although, strictly speaking, the same load cannot be borne by a girder when resting on one flange as if applied at at the top, on account of the torson, yet, by endeavouring to bring it as near to the centre as possible, has not perceived any sensible difference.—1161. If circumstances made it desirable to construct a girder to carry a load on the flange, at some distance from the centre, it might then be desirable to calculate the strength of the girder; would certainly test it in that manner.—1162. Such cases have not been sufficiently frequent to require a special provision. Does not believe that any appreciable difference is caused in the power of resistance of the girder.—1166. Considers that, with his form of girder, and with a large dead load of ballast, &c., the torson is inappreciable.—1167. A soft substance between anything that produces vibration and cast iron is advantageous, but wooden sleepers to support the roadway should not be so elastic as to press on the edge of the flanges of the girders.—1171. Does not consider that a moderate weight left on a girder will ever injure it.—1172. Has not observed temperature produce any effect except expansion and contraction. Considers that no weight, except that approaching the breaking one, will permanently affect cast iron. —1173. The deflection of a girder does not merely depend on the length.—1174. In a girder 30 feet long, and 15 inches deep, would allow 1·40th of an inch to a foot.—1175. The deflection must depend on the form.—1178. About half the before-mentioned deflection would be allowed in a very stiff girder.—1180. Makes girders of the inverted T section with a very large bottom web, and swelling at the top of the vertical web.—1184. The length of cast iron girders is limited by what would insure a sound casting; at present considers it to be 30 or 35 feet.—1189. When girders are required for spans beyond the limits of simple cast iron girders, would prefer not using cast iron at all.—1190. Would prefer timber or wrought iron, or both combined.—1191. Would apply wrought iron to increase the tenacity of cast iron framing.—1192. Has adopted that method in machinery.—1195. In large spans, assuming there is no difficulty in obtaining an abutment, would prefer cast iron in the shape of an arch.—1196. Does not think that in a work put together by a good mechanic, with ordinary judgment and proportionable strength, that any vibration would affect the bolts.—1197. Considers that the introduction of wrought iron plates into the construction of bridges is the most important step that has lately taken place in engineering; believes that with ordinary care, and the improvements which have been introduced into riveting, that the joints may be equal to the other parts of the structure. Does not think vibration can have any effect on well-made riveting.—1199. Rivets should not act as pins or bolts, but like clamps, and hold the plates together by the friction of the one on the other in that manner the plates may be insured not to break in any part contiguous to the rivets. 1201. Considers that the crystalline fractures observed in bars broken by a succession of blows is not the consequence of any internal change in the metal, but that iron breaks with a crystalline or fibrous fracture according to the circumstances under which it is broken; produced several pieces of iron broken, some with a crystalline fracture by a short sharp blow, others with a fibrous fracture by means of a slow heavy blow.—1212. The same effects may be produced by varying the temperature of the bar.—1214. Considers that when the rails are well laid the deflecsion will be less from a moving weight than from that weight at rest.—

1215. Some new engines weigh 35 tons, and occupy a length of 26 feet or one ton and a half to the foot run.—1219. Believes that cast as well as wrought iron varies its strength with the temperature; the colder it is the easier it will break.—1224. Thinks that suspension bridges might be applicable to railways. Has once proposed one under very peculiar circumstances.—1228. Considers the Indian tension bridge inferior to ordinary suspension bridges.—1229. Would only use a lattic bridge when he could not get the materials for the component parts exceeding a certain length: if he were obliged to make a bridge of great length with short sticks, it might be one mode of meeting the difficulty.

*Edwin Clark, Esq.*, civil engineer.—1232. Has superintended the Conway Bridge for Mr. Stephenson. It is a wrought iron tube made of boiler plates riveted together as in iron ship building; the span is 400 feet, the extreme depth at the centre is 25′ 6″, extreme breadth 15 feet; the clear internal depth and breadth are 21′ 8″ and 14′ 3″; the depth at the ends is 3 feet less than at the centre. It was constructed on a timber platform on the beach of the River Conway, 200 yards from its permanent site, and was floated to its position on six pontoons of 350 tons each, and raised 17 feet to its position by hydraulic presses; its weight is nearly 1,300 tons. It has a bearing at each end of 12 feet, and rests on bed plates and rollers to allow of its expansion from change of temperature. It was commenced at the beginning of 1847 and finished in March, 1848. The original idea arose from considering whether a beam could be made large enough to cross a span of 450 feet. Mr. Stephenson had formed beams of separate pieces united by bolts, and had also applied tension rods to some beams formed of separate castings. A cast iron arch was proposed but abandoned, partly on account of interference with the navigation of the straits; two beams side by side with an ordinary upper and lower flange would make a space, through which, if large enough, a railway carriage might pass. The first experiments were on round and oval tubes; they changed their shapes when loaded; rectangular tubes did not; that form was therefore adopted. Experiments were made to determine the resistance of wrought iron to compression, that the actual strength of a large tube might be calculated; the power of wrought iron to resist compression increased as the cube of the thickness of the plates; the strength of the tube varied as the square of the linear dimensions. A model tube one-sixth the real size was made at Mill Wall, and broken five or six times, and strengthened at the part it had broken at after every time, till it was considered that the strength was everywhere proportioned to the strain. The thickness of the sides of the tubes appeared to produce very little comparative effect. The difference of elasticity rendered it difficult to apply cast iron to the top of the tube. A bar of cast iron yields twice as much under the same weight as a similar bar of wrought iron, though its ultimate resistance to compression is four or five times as great. If the top of the tube were made partly of wrought and partly of cast iron, the wrought iron would have to bear more than its share of pressure. Cast iron must also be cast thick, which increases its weight, and the places of junction require heavy flanges. The Mill Wall model it was assumed, if increased to six times its linear dimensions, should be 36 times as strong and 216 as heavy.—1233. The bottom of the tube was considered as a chain, and the plates were lapped over to make the chain as strong as possible; the rivets were proportioned so that the section of the rivet to be sheared through equalled the section of the plate it connected. The shearing strain of a rivet is as its tensile strain. Cells were put in the bottom of the tube as being the most convenient way of getting sufficient area of section of iron. The cells are kept stiff by angle irons. There are five rows of cells in the bottom of the tube. The bottom has great strength to resist lateral pressure, as the wind.—1234. The sectional area of the bottom is to that of the top as 5 to 6. The area of the bottom is 508 square inches; the area of the top 608 square inches.—1235. In the small experiments the top had always failed by buckling, but the strength of plates to resist buckling varied as the cube of their thickness, and the top might therefore in the large tube have been made of the same area as the bottom; but as the top had always been the part to fail, and the data for calculating the resistance to compression were not so complete as those for the resistance to tension, a little was added to the top; 12 tons to the square inch is as much compression as wrought iron can be safely subjected to. At 10 tons per square inch most iron begins to be perceptibly altered in shape.—1236. The first experiments were made before February, 1846. The last Millwall experiment was made in April, 1847.—1237. The sides of the tube were considered a mass of trellice-work so thickly interwoven as to become a solid plate; at every two feet two pairs of angle irons were placed face to face, and running from top to bottom of the tube, one inside and the other out, like vertical pillars, to keep the top and bottom apart.

The side plates are two feet broad. These pillars appear to give sufficient rigidity, as the sides of the tube have never exhibited the least alteration of shape. For a distance of 50 feet from each end vertical plates have been added to strengthen the sides, where the strain was considered greatest. At the ends, to prevent any crushing of the sides, strong cast-iron frames have been inserted. The side plates in the centre are half an inch thick, towards the ends ten-sixteenths of an inch thick; the bottom plates are half an inch thick in the middle, and a quarter inch thick at the ends.—1238. On the principle that the strain on the bottom varies at each point, as the rectangle of the segments into which the tube is divided at that point.—1239. When the sides of the model tubes were thin near the ends, they invariably buckle there. The resistance of the top cells to compression was never exactly ascertained; wrought iron will not bear above 12 tons compression per square inch. The first cells experimented on were oval; the square and circular were then tried; the iron when thin puckered, but a certain thickness of plate answered equally well to prevent the cells, either oval, circular, and square, from buckling, and the iron crushed. The cells were made square, not because the square form is the best to resist compression, but because there were many difficulties in fitting a circular cell in the top of the tube, and lateral strength was wanted to resist the wind, and also all the parts could be more easily got at; the cells are 1 foot 9 inches square, and the plates three-fourths of an inch thick.—1240. As regards tension rivets weaken plates, but rivets increase the strength of plates to resist compression.—1242. Plates riveted together generally break at the riveting, though they derive some strength from the rivet acting like a clamp. The top is a plan of pillars and cells; the section is greater in the centre of the tube than at the ends on account of the greater strain.—1243. Found a difference in the wrought iron from different makers. Some irons stretch more than others, though the ultimate strengths are about the same. The ultimate strength of the iron to resist tension averages 20 tons per square inch.—1246. A great deal depends on the manufacture of iron; some of the iron is very brittle, but its ultimate power to resist tensile strain is as great as more ductile metal. A 12 ton press laid on the top of the tube produced no deflection of the iron, and a 12-ton press fell on the top from a height of 25 feet, and produced no other effect than indenting the place where it fell. The locomotive does not run on the bottom cells, but the rails are on sleepers supported by transverse plates 6 feet apart; the bottom is very rigid. When the wedges were being taken out to let it take its final bearing, the wedges over a large portion of the centre had been left in by mistake, and it was supported by the bottom being bulged up, which was a very severe test; it did not belly up above one inch.—1247. The tube weighs 1,250 tons without the end castings.—1248. When the tube was on its original platform, a straight line was set out along the instrument with a 30-inch telescope, and holes drilled through. The tube was constructed with a camber of 7 inches, that its deflection might not be unsightly. The deflection is sensibly affected by changes of temperature. The motion caused by a cloud passing over the sun, or a shower, was quite visible by the means of an index.—1249. The whole structure is a rectangular tube, 412 feet long, before it was moved to its position; it was floated to its position. When raised, 6 feet at each end were added; the bed for it rest on was 3 inches of creozoted deal, a bed plate 3 inches thick of cast iron, then another layer of creozoted deal, to prevent corrosion, a mass of red and white lead was spread over the timber; one end is thus a fixture; the other is on a bed of iron, which rests on 44 rollers of cast iron, 6 inches diameter, to allow of expansion and contraction.—1250. In addition to this, to prevent the sides being injured, the tube is partly suspended by suspension rods riveted to the tube at each end, which pass through girders bearing on metal balls, running in grooves; it is calculated that one-third is suspended, and two-thirds on the rollers.—1251. The side of the tube is quite closed.—1252. The Conway and Britannia Bridges are on similar principles; the Britannia Bridge has 60 feet more span.—1254. The Britannia Bridge is named after the Britannia Rock in the Menai Straits.—1256. There is one tube for each line of railway.—1258. The calculated deflection of the tube was about 7 inches, so the tube was cambered to that amount. It actually deflected $7\frac{3}{4}$ inches by its own weight. When tested with 330 tons it deflected to $10\frac{1}{8}$ths inches below the original line; on removing the weight it returned to rather more than 8 inches. Probably some rivets had been disturbed. The effect of temperature was found to be very great. The deflections taken at night differed from those taken in the daytime. The expansion of the cells at the top causes it to rise.—1259. It is painted of a light colour, to increase the radiation.—1263. The extremes of temperature cannot have an injurious effect as the motion is only 2 inches over 400 feet span.

—1264. In raising the tube the strokes of the hydraulic presses became isochronous, and the tube vibrated like a springing plank, so that the presses had to be stopped.—1265. A train of 100 tons causes three-fourths of an inch deflection, but no vibration.—1267. Persons in the carriage do not perceive that it is a tube.—1268. There is no increase of deflection since it has been opened for traffic.—1269. The deflection is measured by an instrument attached to the side of the tube. — 1270. There is tremor when a train passes, but no vibration.—1271. It interferes with the reading of a telescope.—1272. The tremor cannot be perceived by standing or lying on the tube, it is greatest when a cannon is fired from the top.

*J. D. Morris Stirling, Esq.*—1273. Has studied the chemical properties of iron.—1274. Cast iron in this country consists of iron, carbon, silica, some phosphates, and other admixtures which may be considered impurities. Cast iron from Sweden and magnetic ore is purer; it contains less carbon. The strongest cast iron contains 3 per cent. of carbon; a mixture of hot blast, No. 1 and cold blast No. 3, will give that proportion, but it would be better for iron with that proportion to be produced at once from the blast furnace.—1275. A small portion of arsenic increases the fluidity of iron.—1277. The higher numbers of hot-blast irons apparently contain more carbon than cold blast. Graphite is commonly to be seen on the surface of No. 1 hot blast, not so frequently in cold. Chemical analysis gives very little difference between No. 1 hot blast and cold blast as regards the quantity of carbon.—1278. It appears to be combined in a different manner; generally, Scotch is the most, and Welch the least carbonaceous iron; Staffordshire is intermediate.—1279. Phosphorus gives the hot short quality to wrought iron.—1280. Manganese closes the grain of iron; apparently improves the quality; gives it a more steely character; increases the property of being hardened by quenching.—1284. It does not give the elasticity of steel. Steel and cast iron are improved by manganese.—1285. Berlin iron owes its fluidity to arsenic.—1286. Dark iron is usually weak, grey usually strong, and white brittle; black iron when chilled becomes white, although it must be supposed to contain the same quantity of carbon; as a general rule, colour indicates the treatment to which iron has been subjected, and, in some cases only, the quantity of carbon.—1288. Would employ colour as a test of strength, but not of chemical constitution.—1289. To resist a transverse strain, grey iron (not approaching to mottled) would be best; to resist a blow, grey iron, approaching to mottled, would be best.—1291. The East Indian iron has many properties of malleable iron; its mixture with other pig iron improves the quality of the latter: small quantities are used in the patent boiler tube manufactory, to improve the iron purchased for making wrought iron.—1295. The best mixture of iron for strength would be, for a large casting, a larger proportion of No. 3 Scotch, Staffordshire, or Welch; for a small casting, a larger proportion of Nos. 1 and 2, and a smaller of No. 3.—1296. Numbers of iron are, however, very arbitrary; mixing iron adds very much to the strength. London founders improve their irons by the use of scrap iron.—1297. Ordnance and hydraulic presses are made chiefly of No. 3: for a girder, more fluid iron would be required.—1300. Iron cast in large masses becomes soft from cooling slowly.—1301. Has proposed to improve cast iron by an admixture of wrought iron.—1302. There is a chemical combination between the two.—1303. The quantity of carbon is diminished.—1304. The grain is much closer. A small quantity of wrought iron added to dark grey iron makes it light grey; a large quantity makes it mottled, a larger still almost white.—1306. Scotch iron requires most wrought iron, Staffordshire less, and Welch iron least. The proportion for Scotch hot blast is for No. 1 from 24 to 40 lbs. per cwt., No. 2 from 20 to 30 lbs.; for No. 3 it is not recommended, as the iron is uncertain in itself. Staffordshire will not bear so much as Scotch; 20 to 30 lbs. would be a high proportion for Staffordshire No. 1.—1308. Welch No. 1 bears the same as Staffordshire; No. 2 requires very much less.—1310. The increased strength of the iron is an advantage mechanically.—1311. From an average of experiments the waste in casting was 7 lbs. per ton in favour of common cast iron. — 1315. The iron planes like wrought iron and the castings are more difficult to trim than those of common iron.—1316. The first object in proposing the iron was to raise the inferior irons to a level with the best, but has obtained a mixture stronger than the strongest.—1317. The improvement on strong irons is not proportionably so much as on weak ones.—1318. It seems to bring irons to an average.—1322. By adding wrought iron scrap to pig iron, and puddling it, the resulting wrought iron is much improved.—1324. Cast iron easily acquires magnetic power, and acquires extreme polarity without the power of attracting small bodies to the degree that steel does. Considers it an advantage that a beam of toughened cast iron need not be so

heavy as that of common iron.—1327. Has observed instances of alteration in the structure of iron from repeated hammering, and shafts exposed to vibration also crystallize.—1328. Considers that, possibly, galvanic action causes the change.—1330. Cold hammering gun barrels too much makes them brittle.—1336. The mixture of wrought iron with cast is made originally in the pig.—1338. The specific gravity is from 7·2 to 7·3; the specific gravity of common iron 6·9 to 7·3.—1342. The centre of a casting should be taken for the specific gravity.—1343. Thinks it would be useful to inquire into the generic differences of irons.

*Charles May, Esq.*, iron-founder.—1344. The difference in the strength of iron appears to consist mainly in the proportion of carbon.—1345. A large dose of carbon makes a very tender iron; the strength appears to be greatest when the carbon is in the smallest proportion that produces fluidity.—1346. The greatest mixture of irons is preferred.—1349. One-third anthracite combined with Scotch is a good mixture for toughness and strength.—1351. For small castings a more fluid iron is wanted than for large ones.—1352. On account of competition, the cheapest iron is often preferred to the strongest.—1353. With the bulk of Scotch iron combines Welch and scrap iron; the mixture is very much reducible to the quantity of carbon.—1354. An iron very hard for small castings would be soft from the slow cooling if run into a large mass. Cast iron does not depend solely upon its constituent parts, but upon the bulk into which it has to be run; these varying circumstances constitute the art of the iron-founder in producing the greatest strength without any very definite knowledge either chemical or mechanical.—1355. By annealing, great toughness can be produced [*produced a shaving taken from the edge of an annealed cast iron wheel*].—1356. Hot blast iron ought to be as good as cold; but, in some cases, advantage has been taken of it to work up an inferior material. Since the introduction of the hot blast, the quantity of carbon combined with iron is greater.—1357. Has not the same confidence for strength in hot blast as in cold blast iron.—1358. Has met with hot blast iron as strong as the strongest iron. The public would have no security in cold blast *versus* hot blast iron.—1359. The fact of specifying for a particular quality of iron is almost nugatory; the principle of testing the work when done should be adopted.—1360. Knows no certain mode of telling different kinds of iron; the manner in which cast iron is modified by the quantity of carbon it contains is shown by chilling. The main feature as regards iron is a question of the proportion of carbon.—1361. Considers Mr. Morries Stirling's mixture very advantageous, particularly for irons too rich in carbon.—1362. Would make the breaking weight of a girder three times the greatest load.—1364. Considers that railway girders are exposed to severe strains from the new foundations, the violent impact they are subjected to, and the load being laid on and removed suddenly.—1365. Would prove a girder to once and a half or twice the greatest load; beyond that there is a chance of damage.—1367. Considers that the side strain, from supporting the load on the bottom flange, would prevent the girder bearing as much as if applied on the top.—1368. Thinks tests should be applied as the weights are applied, in practice; but girders are bought at the lowest possible price per ton, and ten times the profit would not pay for experiments.—1373. Thinks the only limits to the length of simple cast iron girders are practical ones, of handling large masses, and pouring the metal equally to form good castings.—1374. If a large number of large girders were wanted, it might be worth while to erect a new foundry for the purpose.—1377. Is favourable to wrought iron girders.—1378. Considers that wrought and cast iron may be combined, so as to produce an advantageous effect. When weight comes on the cast iron, the wrought iron should take its share of the load.—1379. Considers that, if well made, the joints and rivets of railway bridges would not be injured by the vibration and impact to which they are exposed.—1381. Cites the instance of the beam of a steam engine vibrating continually without suffering any injury, as an instance of iron not being affected by continual vibration; and mentions, in favour of its being so affected, the fact of a gun, employed to break pig iron across, dropping in two after a series of years.—1382. Considers the only security for good work is, to hold the makers responsible for it. Has found great variations in bars of similar metal. Thinks that the breaking weight of a small bar is no index to the breaking weight of a large casting.

*Joseph Cubitt, Esq.*, civil engineer.—1384. Is at present constructing the Great Northern Railway.—1386. Prefers a mixture of Scotch and Welch or Staffordshire and Scotch irons for large castings.—1388. As mixtures are stronger than single irons.—1391. Believes cold blast iron to be stronger than hot blast iron.—1393. Would make the breaking weight of a girder six times the greatest load.—1394. Proves a girder with three times the greatest load likely to come upon it, or half the breaking weight.—1396. Proves girders either with the hydraulic

press or dead weight; strikes them while the weight is on with a large wooden mallet.—1400. Does not consider a girder would bear so much weight if applied on one of the flanges as if applied at the top; prefers loading the girder at the top if possible.—1405. Considers the proportions he adopts as sufficient to compensate for the torsion.—1407. Has often tested girders with the load on the bottom flange.—1410. Has two girders for each line of way, and supports the rails on wooden bearers.—1412. Considers any elastic substance between the rails and cast iron girders of advantage in preventing shocks.—1413. Does not consider it likely that girders would increase the deflection after a length of time.—1414. Would not like a girder of 40 feet span to deflect more than one-fourth of an inch; those he is putting up will not deflect half that amount.—1415. Observes the deflections of girders when testing them.—1417. Adopts Mr. Hodgkinson's form of girder, but makes the top flange rather larger, to give lateral stiffness.—1419. Would not like to go beyond 50 feet for the length of simple cast iron girders.—1423. Beyond that span would adopt timber, wrought iron, or the bowspring bridge.—1424 Has crossed spans of 100 feet by timber bridges and by wrought iron tubes.—1426, 1427. Considers a bowstring girder with a cast iron bow and wrought iron tie a very good combination of wrought and cast iron.—1429. Would prefer wrought iron or timber.—1431. Would use an arch of cast iron if not limited with respect to expense or levels.—1433. Does not consider the impact and vibration to which railway bridges are subjected sufficient to injure the joints and rivets. — 1440. In wrought iron hollow girders takes the depth at $\frac{1}{15}$th of the span. 1441. Subjects them to the same proof that he does cast iron.—1442. Does not observe that they acquire any permanent set.—1444. Has put some up at Doncaster at 70 feet span.—1445. Has found no difference between the effect produced by a weight at rest on a girder and that due to the weight moving at a velocity over it.—1451. Considers the greatest weights running on railways to be the engines, they weigh 25 and 30 tons. Something more than half the weight of the engine is on the driving wheels.—1458. Has preferred for a viaduct near Welwyn, on the Great Northern Railway, brick arches to iron girders.—1461. Approves of the wrought iron girders used in the large spans on the Blackwall Railway.—1465. If kept painted they will last for a long time; in some cases, to prevent torsion, a cross piece of cast iron between the tops of two girders is advantageous.

## IN THE QUEEN'S BENCH,
June 21, 1850.

*Before Lord Campbell and a Special Jury.*

BETTS *versus* WALKER AND ANOTHER.

This was an action brought to recover damages for an infringement of a patent granted to the Plaintiff and Alexander Southwood Stocker, on the 30th December, 1844, for an invention entitled "Improvements in bottles, jars, pots, and other similar vessels, and in the mode of manufacturing, stoppering, and covering the same."*

Stocker, one of the patentees, had assigned all his interest to the other patentee, the Plaintiff, who is a partner in the firm of Betts and Company, the patent brandymakers.

The Defendants are members of the Aire and Calder Bottle Company, and by their pleas they denied the infringement, and alleged the patent to be void by reason of a want of novelty in the invention.

It appeared that the specification of the patent began by stating that the invention related to improvements in bottles, jars, pots, and similar vessels, and consisted in particular constructions of the necks and other parts of such vessels, and the application of suitable stoppering and covering thereto.

The specification then proceeded, with the aid of drawings, to describe several constructions of bottle necks, and of caps for covering the necks when corked. It also described what is termed a modification of the invention, in which a flat disc was introduced within the mouth of the bottle, instead of a cork, so as to act as a support for a metallic capsule to be placed over the end of the bottle; and to support this disc, *an internal bearing shoulder* was to be made within the mouth of the bottle.

The specification also described a method of covering and stopping "vessels of forms having mouths or openings of wide dimensions," which was different from any of the modes before described. It was also stated the patentees formed "any of the constructions therein described, in any of the earthenwares, and also of wood." The machinery for making the various constructions of bottle necks and openings before mentioned was then described; but it was described as machinery for making the necks and openings, or mouths of bottles, *and other vessels*.

The specification concluded with the following claims:—"We claim, as of our in-

* See a report of an argument in a *scire facias* to repeal this patent, *ante*, p. 456, No. 1400.

vention, the application of flexible metallic coverings, in combination with discs or stoppers, for the covering and stoppering of bottles, *jars, pots, and other similar vessels* constructed as above described.

"We also claim the manufacture, herein described, of the tops or necks of bottles, *jars, pots, and other similar vessels*, of the suitable forms and constructions for the application of such flexible metallic covering, and that as we have hereinbefore specified, described, and set them forth in this our specification and drawings."

It was alleged by the Plaintiff's Counsel that the Defendants had become possessed of a subsequent patent granted to A. S. Stocker, for improvements in stoppering bottles, and that bottles made under that patent by the Defendants had internal bearing shoulders, the making of which was an infringement of the plaintiff's patent.

The Plaintiff called witnesses to prove the novelty of the invention, but they admitted, upon cross-examination by the Defendants' Counsel, that before the date of the patent, glass mustard-pots, and other vessels, had been made with internal bearing shoulders. It was also admitted that earthenware jars and pots had been made in a similar manner.

It was then objected, for the Defendants, that as the internal bearing shoulder alleged by the Plaintiff to be a part of his invention was not new, the patent was void, and that if the patent only extended to that shoulder when combined with other things, as described in the specification, the Defendants had committed no infringement.

For the Plaintiff it was contended, that the specification claimed the bearing shoulder as applicable to bottles only, and not to any other vessel, and that in the absence of evidence that *bottles* had been made with such shoulders, there was nothing to impeach the novelty of the invention.

The Lord Chief-Justice (Campbell), however, after hearing the arguments of the Counsel, decided that, although in some parts of the specification the word "bottles" only was mentioned, yet other parts of the specification showed that the claim must be construed as extending also to jars, pots, and other vessels, which it was clearly shown had been made with internal bearing shoulders before the date of the patent.

The Plaintiff was thereupon nonsuited. Counsel for the Plaintiff, Sir F. Thesiger, Mr. Webster, and Mr. Manisty.—For the Defendants, the Attorney-General, Mr. Hindmarch, and Mr. Bramwell.

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SPECIFICATIONS OF ENGLISH PATENTS ENROLLED DURING THE WEEK ENDING JUNE 27TH, 1850.

FREDERICK GEORGE SPRAY and GEORGE NEVETT, Hampstead-road, Middlesex, engineers. *An improved steam engine, parts of the arrangements of which may be applied to apparatus for regulating, measuring, and registering the flow of liquids and gases.* Patent dated December 21, 1849.

*Claim.*—An improved rotary engine, in so far as regards a peculiar construction of the piston, a lubricator, a self-acting feed-apparatus, an alarm whistle, a water and steam indicator, and salinometer, and the application generally of the said feed-apparatus, alarm whistle, and water and steam indicator to regulating, measuring, and registry of the flow of liquids and gases.

WARREN DE LA RUE, Bunhill-row, manufacturer. *For improvements in the manufacture of envelopes.* Patent dated December 19, 1849.

The patentee describes and claims,

1. The applying of gum or cement to the flaps of envelopes folded by machinery in such manner that a part of the folding process shall be effected before, and the rest after the application of the gum.

2. Applying the gum in the manner of surface printing, in contradistinction to the application of it direct from the fountain or reservoir of gum or cement.

3. Causing the envelopes to pass to and under rollers.

4. Combining and arranging machinery in such manner that the envelopes are made to pass between flat surfaces.

5. Certain arrangements and combination of machinery for applying gum to the seal-flaps of envelopes after they are folded.

6. A means of drying envelope paper, and accumulating it in such manner that the pieces may overlap one another without the gummed flaps touching.

7. A means of conveying the envelope to and from the gumming and drying processes.

WILLIAM ACKROYD, Birkenshaw Mills, Leeds, York. *For improvements in dressing and cleaning worsted, and worsted mixed with cotton and other fabrics, after they have been woven.* (A communication.) Patent dated December 19, 1851.

Mr. Ackroyd remarks that fabrics composed of worsted, or of cotton and worsted mixed, have, when they come from the loom, knots or irregularities upon their surfaces which are required to be removed by hand, and that the object of his invention is to effect the removal of these irregularities by machinery. For this purpose he employs a frame, in the upper part of which

are supported two rollers, coated on their peripheries with ground glass, glass paper, or other suitable grit. The frame carries at each end, beneath the level of the lower part of the circumferences of the cleaning rollers, two supporting rollers, and beneath one of these a pair of gripping rollers—the lower one of which is supported in the end of a weighted lever, whereby it is kept in contact with the upper one. The delivery roller on which the cloth to be dressed is wound is supported near to the gripping rollers. The cloth is passed between the two last, which has the effect of retarding its progress—then over the supporting roller at that end of the frame—under the first cleaning roller—over an adjustable roller, whereby the amount of surface of the cloth, in contact with the cleaning rollers, is regulated—under the second cleaning roller—over the supporting—and hence to the taking-up beam. The rollers are driven by a steam-engine.

*Claim.*—Combining parts into a machine for dressing and cleaning woven fabrics of worsted, or worsted and cotton mixed, whereby the irregularities of surface are removed.

FREDERICK HALE THOMSON, Berner's-street, Oxford-street, Middlesex, and EDWARD VARNISH, Kensington, Middlesex. *For improvements in the manufacture of inkstands, mustard-pots, and other vessels of glass.* Patent dated December 19, 1849.

This invention consists in blowing vessels of glass with double sides, that is, when they are intended to contain anything, and hollow elsewhere, and coating them with silver inside, in order that the silvering maybe visible both internally and externally. The silvering is effected by introducing into the hollows a composition consisting of a solution of grape sugar, mixed with a sufficient quantity of the following ingredients:—

1 oz. ammonia,
2 oz. nitrate of silver,
3 oz. water,
3 oz. spirit of wine.

The glass is kept at a temperature of 130° Fah. until the mixture is dried and the silver deposited, after which it is coated with any suitable varnish to protect it from damp.

No claims are made in this specification.

WILLIAM HENRY FOX TALBOT, Haycock Abbey, Esq., and THOMAS AUGUSTINE MALONE, Regent-street, photographer. *For improvements in photography.* Patent dated December 19, 1849.

Mr. Talbot claims, under this patent—

1. The use of unglazed slabs of porcelain to receive photographic images. These slabs are to be composed of the best materials—thin, and semi-transparent; and when requisite, they may be strengthened by being cemented to a slab of glass. The porcelain is coated with a thin film of white egg, then dried, and dipped in a solution of nitrate of silver (25 grains to 1 oz. of water), dried again, and dipped in a solution of iodide of potassium (25 grains to 1 oz. of water). When the plates are required for use, they are treated with a "gallo-nitrate solution," and placed in the camera; after which the image is fixed by washing the slab with water, bromide of potassium, or hyposulphate of soda, and lastly with water.

2. Converting negative photographic images into positive ones by the following means:—A slab of glass, coated with a thin film of white of egg or albumen, is dipped in a solution of nitrate of silver (15 grains to 1 oz. of water). It is then excited by being brushed over with a saturated solution of gallic acid, and placed in the camera; after which the image is treated with a solution of nitrate of silver (30 grains to 1 oz. of water), and washed with water, bromide of potassium, and water.

3. The employment of varnished paper, instead of glass, to receive photographic images. The paper is coated with a thin film of white of egg or albumen, and subsequently treated in the same manner as has been before directed with respect to ordinary paper or porcelain.

4. Obtaining a better fixation than has yet been practicable, by dipping the paper in a boiling solution of caustic potash. The colour of the image is changed into a sepia tint by exposing it to the vapour of sulphuretted hydrogen.

5. Covering steel plates for engraving purposes with a thin coating of albumen, and treating them by the process before described for fixing the image.

JOSEPH WHITWORTH, of Manchester, engineer. *For certain improvements in machinery or apparatus for cutting metals, and also improvements in machinery or apparatus applicable to agricultural and sanatory purposes.* Patent dated December 19, 1849.

The patentee describes and claims,

1. The employment of two cutting tools at the same time, and upon the same article, while being turned. The tools are fixed in two slide rests, one in front, the other at the back of the shears.

2. The use of an additional bottom slide-rest for lathes.

3. An arrangement for making the tool of a planing or slotting machine travel quicker in one direction than in the other, the cut being effected during the slower movement.

4. The employment of a circular disc or

scythe (for cutting grass or reaping corn) placed upon the side of a four-wheeled machine, motion being given to the disc by wheel gearing attached to one of the wheels of the machine.

5. A similar arrangement of horizontal discs covered with brushes upon their lower sides for the purpose of sweeping the channels of streets and ways.

*Specification Due, but not Enrolled.*

JAMES SMITH DEANSTON, Perth.* *For certain improvements in treating the fleeces of sheep when on the animals.* Patent dated December 19, 1849.

### AMERICAN GOLD WASHER.

(From the *Franklin Journal.*)

BALL'S PATENT.

*Claim.*—"I claim, in combination with the mercury bath, a surrounding channel or groove, made to communicate therewith by a passage, and applied so as to intercept the mercury which may be thrown out from the bath, whereby the mercury thrown out is again returned to the central cistern without intervention on the part of the operator.

"And, in combination with the elements above claimed, I claim one or more concentric mercurial ring, arranged between it and the cistern or bath, the same not being made to communicate with the main vessel or bath by any passage; the same being for the purpose of intercepting the small escaped particles of mercury, and retaining them until so washed by the water that they will coalesce with the mercury contained in said ring or rings.

"And I claim the central tube, as well as its perforated water diffusor or tunnel, in combination with the main hollow shaft, its bell-mouth vessel or top, and perforated partition or separator; the whole being made to diffuse and apply the water to the auriferous earth and mercury bath, and prevent packing of it within the tube, essentially as specified."

### WEEKLY LIST OF NEW ENGLISH PATENTS.

Robert Andrew Macfie, of Liverpool, sugar refiner, for improvements in manufacturing, refining, and preparing sugar, also improvements in manufacturing and treating animal charcoal. June 24; six months.

Henry Stephens, of Stamford-street, Blackfriars-road, writing fluid manufacturer, and Edwyn Wylder, of Paddington, Middlesex, mechanist, for certain improvements in ever-pointed pencils, pens, and penholders. June 24; six months.

William Laird, of Liverpool, merchant, for improvements in life-boats, and in apparatus for filtering and purifying water. (Being partly a communication.) June 24; six months.

Joshua Vickerman Binns, of Lockwood, near Huddersfield, York, mechanic, for improvements in piecing wool cardings, and in a machine called a piecing machine. June 24; six months.

Edward Mitchell, of Great Sutton-street, Clerkenwell, gentleman, for improvements in fastenings for articles used for writing, and drawing, and other purposes, and improvements in articles to be used for writing and drawing. June 24; six months.

John Percy, of Birmingham, doctor of medicine, and Henry Wiggin, of the same place, manufacturer, for a new metallic alloy, or new metallic alloys. June 24; six months.

Thomas Fulljames, of Old Kent-road, gentleman, for certain improvements in machinery or apparatus for raising, lowering, and moving weights, or other heavy bodies. June 26; six months.

James Forster, of Liverpool, merchant, for improvements in filtering water and other liquids. June 27; six months.

Joseph Foot, of Spital-square, Middlesex, for improvements in bolters. June 27; six months.

### LIST OF SCOTCH PATENTS FROM 22ND OF MAY TO 22ND OF JUNE, 1850.

George Jackson, of Belfast, Ireland, flax dresser, for improvements in hackling machinery. May 24; six months.

Frederick Rosenborg, of Albemarle-street, Middlesex, Esq.; and Conrad Montgomery, of the Army and Navy Club, St. James'-square, Middlesex, Esq., for improvements in sawing, cutting, boring, and shaping wood. May 24; six months.

George Hayward Ford, of St. Martin's-le-Grand, Middlesex, for improvements in obtaining power. May 27; six months.

Joseph Barrans, of St. Paul's, Deptford, Kent, engineer, for improvements in axles and axleboxes of locomotive engines and other railway carriages. May 27; six months.

Samuel Fisher, of Birmingham, Warwick, engineer, for improvements in railway carriage wheels, axles, buffer, and draw springs and hinges for railway carriage and other doors. May 28; four months.

Thomas Chandler, of Stockton, Wilts, for improvements in machinery for applying liquid manure. May 28; six months.

Thomas Dickson Rotch, of Drumlamford House, Ayr, Esq., for improvements in separating various matters, usually found combined in certain saccharine, saline, ligneous substances. (Being a communication.) May 28; four months.

Henry Columbus Hurry, of Manchester, Lancaster, civil engineer, for certain improvements in the method of lubricating machinery. May 29; six months.

John Dalton, of Hollingworth, Chester, calico-printer, for certain improvements in, and applicable to machinery or apparatus for bleaching, dyeing, printing, and finishing textile and other fabrics, and in the engraving of copper rollers, and other metallic bodies. June 5; four months.

Frederick Albert Gatty, of Accrington, Lancaster, manufacturing chemist, for a certain process, or certain processes for obtaining carbonate of soda and carbonate of potash. June 5; six months.

Jules Le Bastier, of Paris, but now of South-street Finsbury, Middlesex, gentleman, for certain improvements in machinery or apparatus for printing, June 6; four months.

William Robertson, of Gateside Mill, Neilston, Renfrew, Scotland, machine maker, for improvements in certain machinery used for spinning and doubling cotton, and other fibrous substances. June 7; six months.

* The death of this gentleman since the date of his patent—which is the unfortunate cause of its not being specified—has caused a blank among the practical philosophers of his country, which will not be soon or easily supplied. He stood among the foremost in an age of useful men for social benevolence and enlightened views.